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Tribute to Burt Barnes

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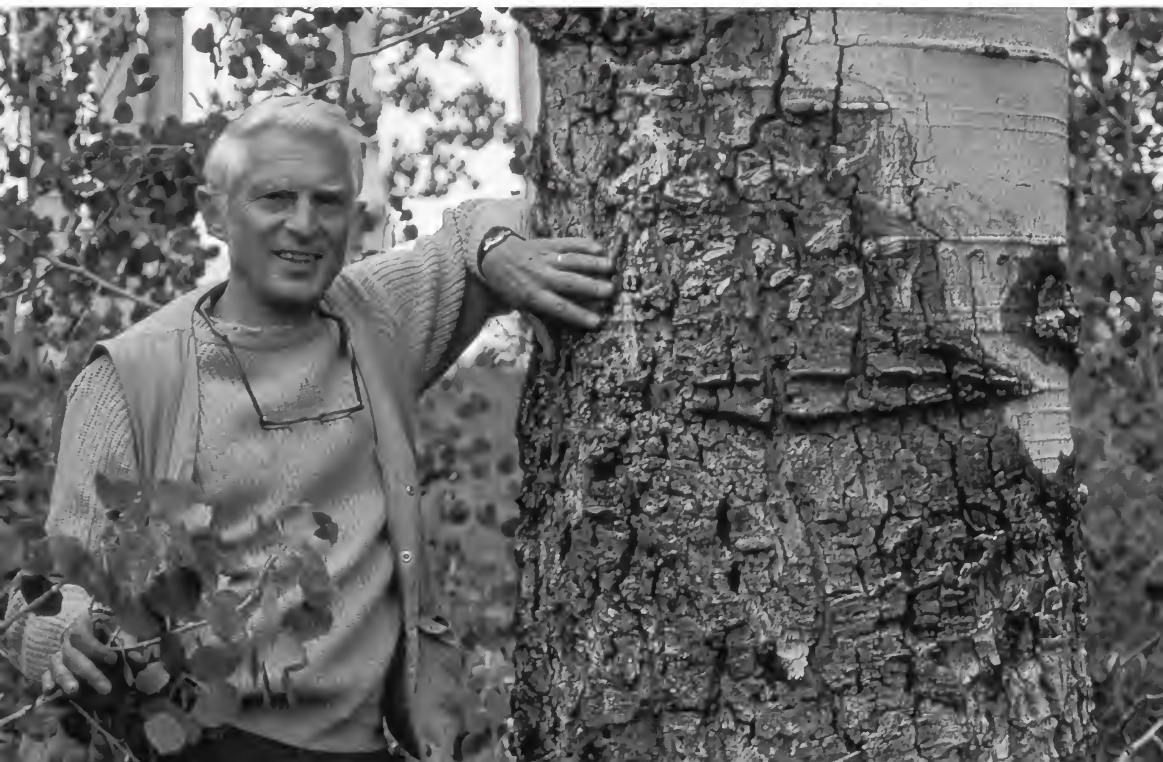

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IN THIS ISSUE

We are pleased to present this special issue of The Michigan Botanist as a tribute to Dr. Burton V. Barnes. Burt left an indelible legacy in Michigan and in the wider world with a career spanning half a century of outstanding and innovative teaching, research, and scholarship and the training of a long list of graduate students. The idea for this issue was first broached in an email I received shortly after Burt's death from one of his last undergraduate students, Susan Fawcett, who offered to write something about him as a teacher or to contribute to a larger effort. A few days later, I received another email from Larry Noodén, who, on behalf of himself and Tony Reznicek, suggested an obituary for Burt. The idea for an issue similar to the one we did a few years ago as a tribute to Ed Voss took shape during a follow-up flurry of emails. It was not until after a few more months, however, that, at Larry Noodén's suggestion, I contacted Dan Kashian, a Master's degree student of Burt's from the 1990s, who enthusiastically accepted my invitation to spearhead this special issue. Dan immediately set to work and commissioned an outstanding suite of colleagues and former students to submit articles about various aspects of Burt's life and career. Dan also did the initial editing of these articles, located appropriate photographs to accompany them, and remained in contact with Burt's family to ensure accuracy, specifically in the initial article. I am especially grateful to Dan for his hard work, without which this issue would not have been possible, and to all of the contributors, who willingly took time out from their busy careers to search their memories and pen these very personal and illuminating essays.

This special issue of invited papers is designed to remember Burt Barnes, mostly through the eyes of his students and colleagues. Burt considered the fate of his legacy very seriously and worried about it in the latter years of his life. We therefore have chosen a subset of that legacy to represent him. Though a more technical, impersonal account of his career and accomplishments might have served, it became clear that stories, intertwined with the facts of his life, were the best way to capture who Burt was. With few exceptions the contributions that follow are therefore personal and passionate, without much regard for separating the organic nature of the authors' emotions from the abiotic reality of his achievements and accomplishments. To Burt, life is Earth, Earth is life, and this is how he would have wanted it.

——Michael Huft

BURTON V. BARNES (1930–2014)

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Sharing tales of those we've lost is how we keep from really losing them.
——Mitch Albom

Organisms per se are born out of Earth, are sustained by Earth, evolve in Earth's skin, and in death and dissolution return to it for cycles of rebirth.
——J. Stan Rowe

Burton Verne Barnes, age 83, died at his home in Ann Arbor on July 3, 2014. He was Arthur F. Thurnau Professor Emeritus of Forestry at the University of Michigan's School of Natural Resources and Environment after a long career as its Stephen H. Spurr Professor of Forest Ecology, and he also served as forest botanist for the Matthaei Botanical Gardens. In remembering Burt we celebrate not only an eminent forest ecologist, botanist, and geneticist, but also a mentor, teacher, colleague, and friend.

Burt was born in Bloomington, Illinois, and grew up in nearby Charleston, Illinois, a small college town about 100 miles west of Springfield. His initial exposure to natural history occurred when he was a boy at Camp Mishawaka in northern Minnesota, where his father worked during the summers. It was at Camp Mishawaka that Burt first began to collect and press samples of flowers, leaves, and twigs. He eventually enrolled at Eastern Illinois University in Charleston in 1948, and transferred to the University of Michigan the following year.

It was at the School of Natural Resources (SNR; later the School of Natural Resources and Environment, SNRE) at Michigan that Burt began to pursue his interests in forest ecology and genetics as an undergraduate in the early 1950s (Figure 1). During the summers he worked for the US Forest Service (USFS) in the western United States on ponderosa pine (*Pinus ponderosa*) and western white pine (*P. monticola*). Burt's job was to climb to the top of trees and collect pollen from male cones and whole female cones for their seeds. As a result of his impatience and in order to save time—something Burt apparently learned to do in his earliest days of field work and maintained throughout his life—Burt and his co-workers developed the habit of leaping from treetop to treetop in an effort to avoid having to climb up and down every tree. When Burt later returned to the USFS as a Research Forester in Idaho, he continued this practice—much to the chagrin of those working under his supervision, whom he asked to do the same. Burt completed his B.S.F. (Bachelor of Science in Forestry) degree at Michigan in 1952 and his M.F. (Master of Forestry) degree in forest ecology and silvicul-

FIGURE 1. Burt Barnes as an undergraduate at the University of Michigan School of Natural Resources Camp Filibert Roth, 1950. Photo courtesy of the Burton V. Barnes estate.

ture just a year later in 1953, using his summer experiences out West to complete a thesis about thinning ponderosa pine in western Montana.

It would be easy and obvious to describe Burt's career and adventures solely with reference to forest ecology, but to ignore music as one of his passions would not accurately represent his life. Those who know Burt well understood his penchant for music—and the trombone as his instrument of choice—and knew that his musical skill and interests were not superficial. He learned trombone in his youth, and he played it in the University of Michigan's Marching Band and Symphony Band (Figure 2). Burt played in the Marching Band under its famous director William D. Revelli. He also enjoyed telling people that he played with, and was a friend of, Dick Smith, who was the drum major leading a group of children across Ferry Field in Alfred Eisenstaedt's famous 1950 photograph in Life Magazine, which has been called "The Happiest Photo Ever Made." Burt used to remark that on football Saturdays, in full band uniform, he felt just like those kids. Incidentally, Burt played in the Snow Bowl vs. Ohio State in 1950 and was an active participant in pushing and pulling the band's vehicles out of the snow on the ride back from Columbus. He also played in the 1951 Rose Bowl, in which Michigan defeated the University of California. Burt claimed to be too busy to be a college football fan, but he always seemed to know the state of the team in any given fall and could easily rattle off the names of players on the teams in the late 1940s and early 1950s.

Burt carried his musicianship with him throughout his teaching career at the University of Michigan, using it in classroom settings and potlucks and as part

FIGURE 2. Burt Barnes in his University of Michigan Marching Band Uniform, 1950. Photo courtesy of the Burton V. Barnes estate.

of "faculty jams" at SNRE holiday parties (the faculty ensemble was known as "The Ecotones," Figure 3). Nothing moved him more than students incorporating music into his courses. Among the hundreds of students in his Woody Plants and Forest Ecology courses over the years were many accomplished or casual musicians and songwriters themselves. Burt encouraged his students to write songs about his courses, if only new lyrics set to old familiar tunes. His four-day fall field trips to the Great Smoky Mountains in Forest Ecology, for example, were fertile ground for musical compositions, most often about the things the students had seen and the adventures they had. More than once Burt was moved nearly to tears upon hearing these compositions, especially when an original melody was attached. He collected these through the years in what he called the "Woody Plants and Forest Ecology Songbook," which he printed and distributed well after his retirement. Burt also had a dream he often talked about, in which he would form a traveling two-piece act with his son Brooks—himself an accomplished professional trombonist.

Burt was soon drafted during the Korean War, and his keen musicianship and pacifism led him to play in the US Army Band between 1953 and 1955 at Ft. Knox in Kentucky. He also graduated from the US Naval School of Music in 1954. Though he was not an openly political man, Burt was a self-described "dove"; he was a very outspoken proponent of peaceful resolution to conflict and bristled at the discussion of war. Throughout his career, he referred to each of the conflicts in Korea, Vietnam, the Persian Gulf, Iraq, and Afghanistan as "This stupid war!" (or "*That* stupid war!" if speaking in retrospect). At the onset of several of these conflicts, he would display a cardboard sign reading "Peace" in the front window of his house. He was very outspoken about his view that students should remain in college rather than being drafted into military service that date to his own time in the Army. He wrote a well-articulated letter in the 1950s, now on file at the Library of Congress, that detailed his belief that college students were more useful in school than at war. During the Vietnam War, Burt was well-

known for persuading students to attend graduate school in order to obtain deferments from the draft.

Burt returned to Ann Arbor in 1955 to begin a doctoral program under the guidance of Stephen H. Spurr (Figure 4). It was during this period that Burt began to build his expertise in the growth, development, and ecology of North American aspens (*Populus* spp.), particularly at the University of Michigan's Biological Station (UMBS). Burt liked to tell the story that Spurr took him out onto the Pellston Plain, waved his arms at the scraggy aspen, and asked him to figure out how to tell the difference between the aspen clones. Burt replied "You're the boss," and proceeded to develop a seminal study on the clonal growth of aspen. He differentiated the clones based on minute differences in leaf and branch morphology, fungal infections, bark characteristics, and the timing of spring leaf flush. He also excavated and carefully mapped complete aspen root systems as part of this work (Figure 5). Burt's work at UMBS in the 1950s convinced silviculturalists and foresters at the time that aspen contained an enormous amount of genetic variation, evident at the clonal level, far more than was recognized at the time. He published much of this work in 1966 in the journal Ecology, in a paper that is still cited by many ecologists today. He completed his PhD in forest ecology and forest botany in 1959.

FIGURE 3. Burt Barnes, in German holiday regalia, plays trombone with the "Ecotones," a faculty ensemble that entertained at SNRE holiday parties, December 2005. Photo courtesy of Shaw Lacy via University of Michigan School of Natural Resources and Environment Flickr page under a Creative Commons Attribution 2.0 Generic license; desaturated from original; original at www.flickr.com/photos/snre/14639936173/.

Burt worked as a Research Forester for the USFS in Moscow, Idaho, from 1959 to 1963, continuing to pursue his interests in forest genetics with a specific focus on western white pine (Figure 6). His work from this period dominated his early publication record and would help to direct his initial research at the University of Michigan. During 1963 and 1964, Burt completed a Postdoctoral Fellowship at the Forest Experiment Station of Baden-Württemberg in Stuttgart-Weilimdorf, Germany. His work in Baden-Württemberg exposed him to a multifactor, multiscale ecological classification approach that focused on interactions, integrating ecological factors simultaneously in the field. The approach was to transform Burt's research when he brought it to Michigan and refined it

FIGURE 4. Burt Barnes in Ann Arbor during his doctoral years, 1955. Photo courtesy of the Burton V. Barnes estate.

FIGURE 5. Burt Barnes with an excavated aspen seedling at the University of Michigan Biological Station, 1957. Photo courtesy of the Burton V. Barnes estate.

beginning in the late 1970s and early 1980s. Burt was convinced that this "landscape ecosystem approach" provided an ecological framework for management of all kinds, including preservation, conservation, and ecological diversity, as well as ecological research. Burt and his students were influential in having the approach adopted by the USFS and The Nature Conservancy in Michigan and elsewhere (see Albert et al. *this issue*).

Burt was hired onto the faculty of SNR at Michigan in 1964 (Figure 7). Soon after his arrival, Burt worked with Warren H. ("Herb") Wagner, Jr., an eminent botanist and former member of his dissertation committee, and with his graduate students to develop the Woody Plants course (see Sharik *this issue*). Woody Plants was a novel, innovative version of a dendrology course whereby students would learn trees and shrubs in the field in their native ecosystems. Throughout his career, Burt valued the importance of his teaching, and he grew particularly infatuated with perfecting his technique (see MacGregor and Gunn, *this issue*). Burt considered his relationship with Herb Wagner to be instrumental to his pedagogy, and their collaboration in Woody Plants is legendary at Michigan and elsewhere (see Dick et al. *this issue*). During this period,

FIGURE 6. Burt Barnes sighting field plot lines in northern Idaho, 1962. Photo courtesy of the Burton V. Barnes estate.

Burt also developed and perfected his Forest Ecology course, which included weekly field labs and long field trips to the UMBS and the Great Smoky Mountains (Figure 8). Many professors at SNR/SNRE modeled their teaching technique after Burt's to the extent that they could (and tempered their frustrations when they failed to duplicate his success). Burt garnered many awards during his career, but those honoring his successes in teaching were among those he treasured the most. They included the University of Michigan Teaching Award, the

FIGURE 7. Drs. Fred Knight and Burt Barnes walking to the School of Natural Resources at the University of Michigan, April 1968. Drs. Knight and Barnes regularly carpooled to campus together. Photo by Bruce Dancik.

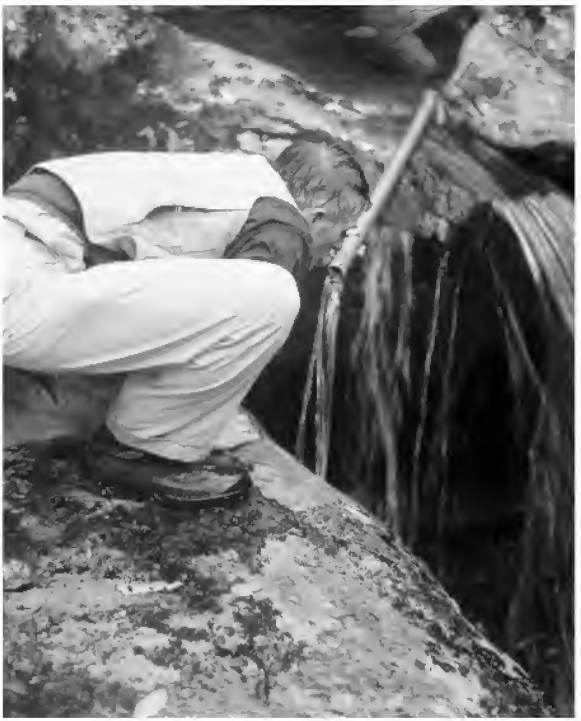

FIGURE 8. Burt Barnes uses an aluminum pruning pole to access drinking water below Ramsey Cascades, Great Smoky Mountains National Park, October 1969. Photo by Bruce Dancik.

Arthur F. Thurnau Professorship for "outstanding contributions in undergraduate education," Students for SNRE Outstanding Teaching Award, the Golden Apple Award, the Michigan Professor of the Year Award from the Council for Advancement and Support of Education, and the Carl Alwin Schenck Award from the Society of American Foresters in recognition of demonstrated and outstanding performance in teaching and forestry education. In 2004 the Michigan Sierra Club established a new award named the Burton V. Barnes Award for Outstanding Academic Contributions in Support of Michigan's Environment, with Burt as the initial recipient.

Burt was very proud of his work with his mentors throughout his University career. He joined Stephen Spurr as the junior author on the second edition of *Forest Ecology*, a well-known textbook in the field, which was published in 1973. Burt revised the text for a third edition with Spurr in 1980, and included him posthumously as a co-author on the fourth edition, published in 1998. Burt worked with Herb Wagner to publish the enormously popular *Michigan Trees* in 1981, a trees and shrub identification guide treasured by students, naturalists, ecologists, and outdoor enthusiasts. He revised *Michigan Trees* in 2004 and maintained Wagner as a posthumous co-author. Burt was completing a new book, *Michigan Shrubs & Vines*, with coauthors Chris Dick (who replaced Burt

FIGURE 9. Burt Barnes measures height growth of aspen hybrids at the southern Michigan nursery in Brighton, Michigan, 1965. Photo by Bruce Dancik.

as an instructor for Woody Plants upon his retirement) and Melanie Gunn (a former student and co-instructor), at the time of his death.

Upon his appointment to the faculty at Michigan, Burt continued his investigations of North American aspen; some of this work led to Burt's work with Herb Wagner on hybridization and introgression in aspen throughout the 1960s and 70s (Figure 9). Barnes and Wagner once thought they had discovered a new hybrid species that had arisen between the two native Michigan aspens, trembling aspen (*P. tremuloides*) and bigtooth aspen (*P. grandidentata*). Wagner named it the Barnes aspen (*Populus* × *barnesii*), only to discover that the species had already been named (*Populus* × *smithii*). With no offense taken and a good story to tell to students for decades, Burt continued to study and document the species and its intermediates throughout his career. Burt's early career at Michigan also focused on the natural variation, hybridization, and genecology of birches (*Betula* spp.) and ashes (*Fraxinus* spp.) with his early graduate students. In addition to a suite of publications, this work eventually contributed to the naming of a new birch species, the Murray birch (*Betula murrayana* B.V. Barnes & Dancik), identified at Saginaw Forest in 1985 (see Dancik, *this issue*). The Murray birch is recognized as a rare birch species resulting from a cross between a native hybrid species (*Betula* × *purpusii*) and yellow birch (*B. alleghaniensis*).

As a part of his aspen work in the West, Burt began to examine an extremely large trembling aspen clone southwest of Fish Lake, Utah, in the late 1960s and early 1970s. Using aerial photography and the same morphological differentiation techniques he developed for aspen at UMBS for his dissertation, Burt con-

cluded that the aspen forest that covered about 106 acres was a single aspen clone, quite possibly the "world's largest organism." Other than a single publication about aspen clone size and another great story to tell his students, Burt's studies on the Fish Lake clone were relatively obscure. The clone was revisited by several researchers in the early 1990s who confirmed Burt's original findings using modern molecular techniques. Those researchers pursued and garnered substantial national media coverage and even named the clone "Pando". In the meantime, Burt continued to avoid media attention, even when comments were requested directly from him. He even quietly attended public tours of the clone unrecognized in the 1990s and 2000s, happily keeping his identity and expertise unknown to the researchers leading the tour (some of whom, when they were told after his death of his possible presence, nervously tried to recollect whether he might have been there!). Instead, Burt chose to poke fun at his overlooked fame with his students in Woody Plants and Forest Ecology with lectures about "the WLO" and rallying cries like "Aspen über alles!"

Burt's research also took him to China, where he was interested in comparing woody plant species and ecosystems between eastern Asia and eastern North America (see Makino et al., *this issue*). Burt began his research in China during the height of the Cold War in the early 1980s and was one of the first western scientists to visit China during that period. Despite this significant hurdle, he accomplished significant collections of "sister species" and was able to conduct extensive field research across remote areas in eastern China, including the rugged Yellow Mountains. Burt returned to China as a Visiting Scientist in the mid-1980s, where he was hosted by the Nanjing Institute of Forestry. He studied forest ecosystems and Chinese aspen species in the Changbaishan Preserve in northeast China and made visits to Shenyang and Liaoning Provinces, as well as to Beijing. He returned to China again in 1992. Burt served as the adviser for several Chinese graduate students at SNR/SNRE as a result of the connections he made from these trips.

Burt's research beginning in the 1980s saw a proliferation of the landscape ecosystem approach he first encountered in Baden-Württemberg and later refined and applied to the study and management of forest ecosystems in Michigan (see Albert et al., *this issue*). Burt and his students first applied the landscape ecosystem approach—an integration of climate, landforms, and soil, and biota—at local scales to wilderness tracts in Michigan's Upper Peninsula, but his focus quickly turned towards a regional classification of Michigan's ecosystems, which he completed with his students in the mid-1980s. The usefulness of the approach culminated in a 10,000 acre classification and mapping of UMBS at multiple scales in the 1990s, including broad glacial landforms, specific types of landforms, and local landscape ecosystems. The classification, with a level of detail that is unique to the United States, still forms the basis for many of the field research projects at UMBS. Burt and his students began to apply the approach to many types of ecological systems in northern and southeastern Lower Michigan and continued to do so until he retired in 2006.

Burt's development and use of his landscape ecosystem approach led to a long-standing friendship and collaboration with Canadian plant ecologist J. Stan Rowe. Burt developed an ecocentric world view from these influences, believing

that biota cannot live on their own but are conferred life from the Earth, such that Earth itself is Life. In terms of his research, this meant that ecological science should focus on the study of whole, volumetric, air-biota-land systems (ecosystems) rather than simply the species they contain. Burt became steadfast in this philosophy, and it began to permeate every new bit of research he undertook; what once would have been studies on aspen or red maple (*Acer rubrum*) became work on aspen or red maple *ecosystems*. His perspective created some tension with some of his colleagues and mentors, including Herb Wagner himself, who considered the lack of a focus on species to be a potential threat to the conservation of biodiversity.

Beyond his science, however, Burt began to consider the inherent and metaphysical value of whole ecosystems, and he believed that because humans were not the center of these systems they perhaps should not attempt to attain their control and management, even when their intentions were good. He believed that an understanding of whole ecosystems would provide guidelines for human behavior, and, as a result, his ecological ethics became more conservation-minded than ever. In one of his last bits of public writing in 2013, Burt provided written testimony to the Michigan State Senate opposing Senate Bill 78, which would have prohibited the Michigan Department of Natural Resources from using biodiversity in its management decisions. After a scathing review of why species depend on the ecosystems to which they belong, he concluded that the bill was "divisive, counterproductive, mean-spirited; couldn't be worse. As Mark Twain said of a book he reviewed—it is a cemetery." It was a fitting summation of a piece of legislation that clearly offended his perspective of the world, and his testimony went viral on the Internet.

Burt officially retired in 2006, and decided to hold a "Burt's Biostation Bash" at UMBS rather than a typical retirement party in Ann Arbor. Burt's Bash was held to reaffirm Burt's message about the importance of learning ecology in the field, and consisted of a full weekend of field trips and activities at UMBS. Hundreds of current and former students and colleagues from across North America attended to hear Burt teach in the field one last time (Figure 10.) The weekend culminated in a "rally" in the lecture hall, where the audience was loud with yelling and singing, skits and impressions about Burt were performed by his former students, SNRE administrators were present, and Burt was asked to speak about his career. True to form, Burt declined to talk about himself and instead did his best to encourage the audience to speak to the administrators about the importance of retaining field courses at SNRE.

After retirement, Burt remained steadfast in both research (see Dick et al. *this issue*) and teaching, including numerous field courses at UMBS through 2010 (Figure 11). Burt had earned many awards and recognitions for his research by the time he retired, including the Michigan Society of American Foresters' John L. Arend Research Recognition Award, the Society of American Foresters' Barrington Moore Memorial Award for outstanding research in forest ecology, The Great Seal of the State of Michigan, and a State of Michigan Special Tribute from the 93rd session of the Michigan Legislature and Governor Jennifer M. Granholm. He was awarded a Lifetime Achievement Award by the Michigan Botanical Club in 2013. His long and illustrious career (Figure 12) resulted in six

FIGURE 10. Burt Barnes teaches from a soil pit to generations of current and former students and colleagues at his "Biostation Bash" retirement party at the University of Michigan Biological Station, July 2006. Photo from University of Michigan School of Natural Resources and Environment Flickr page under a Creative Commons Attribution 2.0 Generic license; desaturated from original; original at www.flickr.com/photos/snre/14420508600/.

FIGURE 11. Burt Barnes teaches students in a mini-course at the University of Michigan Biological Station, 2006. Photo from University of Michigan School of Natural Resources and Environment Flickr page under a Creative Commons Attribution 2.0 Generic license; desaturated from original; original at www.flickr.com/photos/snre/14606564982/.

FIGURE 12. Burt Barnes collecting increment cores in 1952 (left) and in 1993 (right). Left photo courtesy of the Burton V. Barnes estate; right photo by Dan Kashian.

books, three book chapters, and 97 published papers to date, and several more are expected to be published posthumously, as well as an enormous sphere of influence that has produced hundreds of works of research by his former students.

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GRADUATE STUDENTS SUPERVISED OR CO-SUPERVISED BY BURTON V. BARNES

1960s

M.S. 1965. James L. Bertenshaw
M.S. 1966. Thomas R. Crow
M.S. 1966. Ronald O. Gibson
M.S. 1966. Douglas A. Mead
M.S. 1967. Henry L. Caulkins
M.S. 1967. Bruce P. Dancik
M.S. 1968. Gary E. Andrejak
M.S. 1968. Karl W. Johnson
M.S. 1969. Richard H. Barnes
M.S. 1969. James A. Capony
M.S. 1969. William E. Hammitt

1970s

Ph.D. 1970. Terry L. Sharik
Ph.D. 1970. Robert K. Shepard
M.S. 1970. Paul W. Johnson
M.S. 1970. Jerry A. Kemperman
M.S. 1971. Thomas O. Baily
Ph.D. 1972. Bruce P. Dancik
Ph.D. 1972. Gustav A. Steneker
Ph.D. 1972. Sylvia M.O. Taylor
Ph.D. 1973. Stephan S. Clark
M.S. 1973. Ellen S. Post
M.S. 1974. John L. Hart
M.S. 1974. Ann Shorger
M.S. 1975. Richard R. Braham
M.S. 1975. Carolyn T. Cohen
M.S. 1975. Kenneth A. Wearstler, Jr.
M.S. 1976. Urias D. George
M.S. 1976. Robert M. Henry
M.S. 1976. Ross A. Melick
M.S. 1976. Raymond Nichols (non-thesis)
M.S. 1977. John C. Brissette
M.S. 1977. Michelle M. Farmer
Ph.D. 1978. William E. Hammitt
M.S. 1978. Kurt S. Pregitzer
M.S. 1978. Thomas A. Spies
M.S. 1979. Kathleen M. Landauer

1980s

Ph.D. 1981. Kurt S. Pregitzer
M.S. 1981. Richard W. Seelig
M.S. 1982. Shirley R. Denton
Ph.D. 1983. Thomas A. Spies
M.S. 1983. Dennis A. Albert
M.S. 1983. Robert J. Ayotte
M.S. 1983. David M. Hix
M.S. 1983. Wendy O'Neil
M.S. 1983. Constance H. Ruth
M.S. 1983. Deborah L. Skoller
M.S. 1983. Steven P. Voice
Ph.D. 1984. Lloyd Simpson
M.S. 1984. Evan D. Mercer
M.S. 1984. Vera H. Spooner
M.S. 1984. X. Yin
Ph.D. 1985. Shirley R. Denton
M.S. 1986. Glen A. Chown (M.S. project)
M.S. 1986. Steven D. Kvarnberg (M.S. project)
M.S. 1986. Robert A. Plotzer (M.S. project)
M.S. 1986. Stephen J. Shipe (M.S. project)
M.S. 1986. James F. Welsh (M.S. project)
M.S. 1986. Charles G. Wertheim (M.S. project)
Ph.D. 1987. Louis Archambault

M.S. 1987. Patrick J. Comer
M.S. 1988. Xiaoming Zou
M.S. 1989. John W. Fody

1990s

Ph.D. 1990. Dennis A. Albert
Ph.D. 1990. Thomas Simpson
M.S. 1990. Marc Lapin
M.S. 1993. Andrew Johnson
M.S. 1993. Gregory P. Zogg
Ph.D. 1995. Douglas R. Pearsall
M.S. 1995. Matthew E. Baker
M.S. 1996. Melanie E. Gunn
M.S. 1997. Edward H. Trager
M.S. 1998. Daniel M. Kashian
M.S. 1998. Richard M. Ring
M.S. 1998. Ikuyo Saeki
M.S. 1998. Joel Brammeier (M.S. project)
M.S. 1998. Yvette Capps (M.S. project)
M.S. 1998. James L. Ellis (M.S. project)
M.S. 1998. Andrew P. Galvin (M.S. project)
M.S. 1998. Jennifer Santi Hall (M.S. project)
M.S. 1998. Michelle J. Huffman (M.S. project)
M.S. 1998. Thomas Hulleberg (M.S. project)
M.S. 1998. Julie C. Rodriguez (M.S. project)
M.S. 1998. Jeffrey Baranyi (M.S. project)
M.S. 1999. Glenn R. Palmgren
M.S. 1999. Wayne S. Walker

2000s

M.S. 2000. John V. Syring
M.S. 2000. Laura L. White
M.S. 2001. Alan J. Tepley
M.S. 2002. Kara A. Moore
M.S. 2002. Ryan O'Connor
M.S. 2003. Catherine A. Yanca
M.S. 2003. Ephraim Zimmerman
M.S. 2005. Jeffrey G.-P. Lee
Ph.D. 2006. Wayne S. Walker
M.S. 2006. Martha R. Yocum
M.S. 2006. Rebecca Schillo (M.S. project)
M.S. 2006. Jennifer Stover (M.S. project)
M.S. 2006. Stephanie Pendergrass (M.S. project)
Ph.D. 2009. Yuka Makino

CHASING BIRCHES, LIFE, AND ART WITH BVB

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After growing up outside of Chicago and in rural northern Wisconsin, I came to the University of Michigan in the fall of 1962 to major in forestry at the School of Natural Resources (SNR). Two years later, in the fall of 1964, I met Burt Barnes soon after he had returned to Ann Arbor, when I took his Silviculture course (which really emphasized forest ecology rather than silviculture). His enthusiasm for the topics, his intense interest in all of the students, and his good humor were infectious. He readily brought his knowledge and appreciation of art and music into the classroom, which included performances of "You Gotta Know the Territory," "76 Trombones," and other numbers from the Music Man. Just recently I found the postcard from Burt that reported my final grade, with a little handwritten congratulatory comment ("top bananananana!") in his distinctive, tiny penmanship next to the final grade.

By the summer of 1965, when I was a teaching assistant at Camp Filibert Roth for the SNR's Forestry summer camp, Burt asked me to be a teaching assistant for his Forest Ecology and Silviculture courses the following academic year. I thought I had learned a lot as a student in his classes, but serving as a teaching assistant for Burt Barnes intensified and increased that learning. His insights and gentle prodding helped guide and develop, not only critical thinking abilities, but also mentoring and teaching skills. Those assistantships immensely enriched my undergraduate experience.

It seemed only natural to step right into a master's degree program when I completed my undergraduate degree in December 1965. Terry Sharik and I were among Burt's early grad students at a time when students did not address or refer to professors by their first names. "Dr. Barnes" seemed a bit too formal, however, so we hit upon using our initials to address each other. Burt became "BVB," Terry became "TLS," and I was "BPD," forms of address and reference that continue to this day. Under BVB's supervision, I studied a population of yellow birch (*Betula alleghaniensis*), bog birch (*B. pumila*), and their hybrids around Walsh Lake in the Waterloo Recreation Area northwest of Ann Arbor. My project mostly involved the study of vegetative and reproductive morphology, but I also investigated the pollen of all of the plants, and that got us thinking about the often poorly-formed empty pollen grains and the occasional huge, seemingly normal, pollen grains of the putative hybrid plants. That investigation was extended later to some observations we had about a couple of unique birch trees that grew in the lowland forest around Third Sister Lake at Saginaw Forest and that Frank Murray, then forest manager for the University's Forest Properties,

had asked us about. We later published our proposal that those unique birches were specimens of a new species, *B. murrayana*, the Murray birch, a species that resulted from pollination of a female yellow birch by pollen of an unreduced hybrid (yellow birch x bog birch). After I completed my Master of Forestry degree with BVB, I continued on to work on a PhD with him, studying natural variation in leaf morphology of yellow birch across the Great Lakes region. While he was on sabbatical in Germany in 1970, I taught his portion of the Woody Plants course with Herb Wagner.

I have many fond and humorous memories from those years. One day, just before TLS and I were heading out for our summer field work and collecting, we and a few other students were riding with BVB from the Matthaei Botanical Gardens. BVB, driving with a zeal only his family and students would understand, zoomed swiftly up the hill to Dixboro Road, gave us last-minute instructions for our summer of field work, and admonished us, "Now remember, no more than 10 miles an hour over the speed limit." BVB, TLS, and I had a few memorable collecting trips for birches through southern Indiana and the southern Appalachians and through New England and adjacent parts of Canada. We were once stopped along a remote road in the Appalachians by a train engineer who had stopped his train on the adjacent railroad track and asked, "Are you all the boys who are pickin' leaves?" (We had arrived late the previous day in the nearby town, and word must have spread about these strange guys with pruning poles, tree ladders, collection bags and envelopes, and plant presses.) We forded streams of indeterminate depth with our rented University sedan (Figure 1), and I was known to utter, "I hereby relinquish all responsibility for what happens here." What cherished memories of our adventurous times in grad school!

FIGURE 1. Burt Barnes and Terry Sharik fording the Little River, West Virginia, in a University sedan, June 1966. Photo by Bruce Dancik.

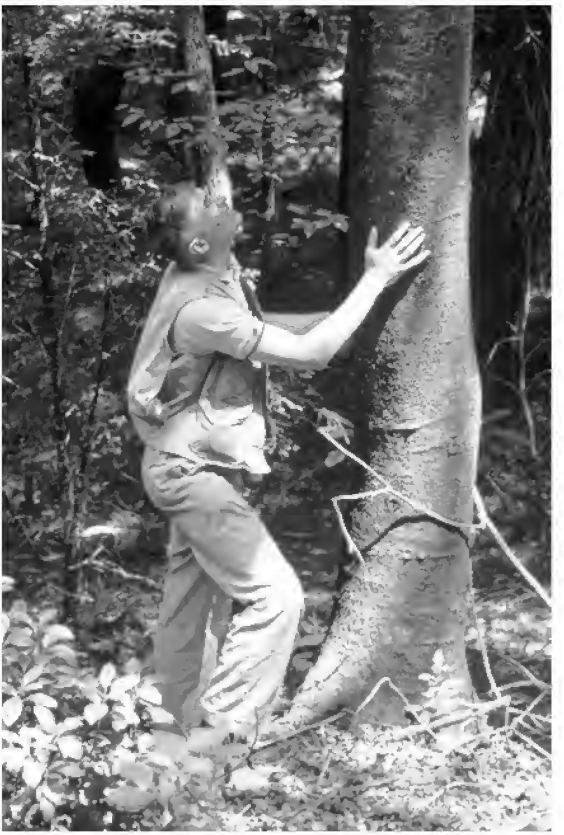

FIGURE 2. Burt Barnes with *Betula lenta* at Burns Creek in the Jefferson National Forest, Virginia, June 1966. Photo by Bruce Dancik.

In the fall after those collecting seasons, we would often be invited to BVB and Dixie's home for dinner. Those dinners invariably would be followed by a slide show of photos from our field season. The slides often included many images of bark of different birches (Figure 2), and, while those of us who were deep into our appreciation of variation in the morphology of birches and the interpretations of the differences among genotypes might be "ooh-ing" and "aah-ing" over the images, our spouses or significant others were having a hard time staying awake or at least appreciating the finer points of birch variation. BVB welcomed us and our spouses and friends into his home and his life and took an interest in everybody; he drew out the best in the group at hand (I was even recruited as an occasional baby-sitter for the Barnes' children!). He shared his perspective and expertise, his broad range of interests and his ability to draw others into conversations, all with a compassionate and considerate demeanor. BVB's influence on so many of us and the esteem with which we held him was apparent at "Burt's Biostation Bash" that was held for him at the University of Michigan Biological Station in 2006, when so many past students and colleagues came from all over North America to honor him.

After I had moved to western Canada, Burt and I kept in close contact and shared many visits. Brenda and I introduced BVB to the work of a group of Canadian landscape artists (the Group of Seven) who painted from the 1920s through the 1960s, and he became enamoured with their work. BVB was especially enthusiastic about the work of one of the biggest influences and predecessors of the Group of Seven, Tom Thomson. BVB felt that the Canadian artists captured the essence of forest ecosystems (Figure 3), and he would often pick

FIGURE 3. Burt Barnes preparing for a lecture in Woody Plants using Tom Thomson books as a demonstration, November 1997. Photo by Dan Kashian.

out individual shrub or tree species or ecosystem types from the paintings. He later used one of Tom Thomson's paintings as the frontispiece of the 2004 edition of *Michigan Trees* (see Dick et al. *this issue*). BVB and I arranged to meet several times in Toronto, Ottawa, Edmonton, Victoria, and Washington, D.C. to visit, tour galleries, look at trees and forests, and catch up on our lives. BVB and Dixie also flew to Spokane and drove from there to meet us near Nelson, British Columbia, where, among other things, we visited with Stan Rowe at his retirement home in New Denver, B.C. BVB and Stan were steadfast colleagues and friends who shared a passion for their work and a vision about landscape ecosystems, and Stan made the arduous trek by bus and plane to Ann Arbor more than once to give guest lectures in BVB's courses.

BVB's teaching, his natural approach to research questions, his interest in his surroundings, his love of music, wine, and food, and his life values all influenced me throughout my career and my life. His discipline, good nature, respect for others, enthusiasm in teaching, good humor, welcoming demeanor, humbleness, and generosity with time and advice should serve as a model for an excellent professor, researcher, or teacher anywhere. During the time I worked with BVB, I learned to be a better listener and a more helpful teacher. I taught a woody plants course at the University of Alberta for many years that was modeled after his course at Michigan, and I still rely on past lab experiences with BVB at Michigan when I lead tree and shrub tours around campus and at the Devonian Botanic Garden in Edmonton. Similarly, I modeled my forest genetics and tree

improvement classes at Alberta after his course at Michigan, emphasizing an ecological genetics approach to forest trees with the graduate students I mentored over the years. I value the many discussions we had over the years on ecology, genetics, evolution, politics, the military, pacifism, peace-keeping, and life in general.

BVB and I exchanged many packets of clippings over the years. I would keep him apprised of the Canadian viewpoint on many American policies, political practices, and various causes, and he kept me supplied with numerous New Yorker political articles and cartoons. While I was editor of the Canadian Journal of Forest Research in the 1980s, BVB served as an associate editor and was a frequent referee for many manuscripts. He wrote some of the very best, thoughtful, insightful, and just plain helpful reviews, and thereby helped dozens of authors. BVB and I shared a constant stream of letters, postcards, emails, and phone calls over the years, and I probably have hundreds of letters, cards, and hard copies of emails, and many fond memories of our frequent phone calls. I still sometimes pick up the phone when it's ringing and almost expect to hear him on the other end saying, "BPD, this is BVB." I am particularly happy that TLS and I were able to meet BVB at his home in Ann Arbor in June 2014 (which we realized was 50 years after Burt, Terry, and I had first met) just a few weeks before he passed away. Even though BVB obviously was very ill and in pain and knew he was not going to live very much longer, he exhibited his usual sharp wit and sense of humor.

Burt was a great teacher, scientist, and human being; those who were fortunate enough to cross paths with him will forever be grateful for his wisdom and companionship. He was a friend and mentor, and I know I am not alone when I say I miss him very much.

BVB AND THE EARLY DAYS OF "WOODY PLANTS"

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I came to the University of Michigan's School of Natural Resources (SNR) in the fall of 1964 as a Master of Forestry student, working under Dr. Grant Sharpe, who headed up the Forest Recreation program there, one of the few programs of its kind in the United States. Having completed my B.S. degree in Forestry (with a Wildlife Management option) at West Virginia University, I became increasingly interested in the human dimensions of natural resource management. It is worth noting that if one wanted to study in this area, recreation was really the only field in which to do so (excluding economics, which had a very narrow perspective on social science). Thus, it was natural that I chose to study with Grant, whose area of expertise was natural history interpretation. That fit me very well, because this was where my chief interests resided. Moreover, he taught the Dendrology course, which was designed in such a way that the faculty member gave the lectures, and the labs were taught by a teaching fellow, the only such position in SNR at that time. I was delighted when the offer to come to SNR also included the teaching fellowship in dendrology, since my love of nature focused heavily on the natural history of trees. I recall how I scrambled to find field sites for the outdoor lab sessions, which I had to do, because Grant pretty much left it to me to decide on teaching sites. As I recall, the lectures were organized by genera, and species within genera—the traditional way of teaching about trees at the time. The labs were then used to reinforce the lectures.

Burt (whom I always called "BVB") accepted a faculty position in SNR in 1963, but spent his first year as a post-doctoral researcher in Germany, so I did not interact with him during this time. Apparently, the decision was made to have him teach the Dendrology course upon his return from Germany, along with forest ecology and silviculture, but the latter two apparently not until his second year in residence (the third year of his appointment). That I was awarded the teaching fellowship required in some sense that he work with me, and so our relationship began in earnest in the summer of 1965, when we set about developing the course in a way that made sense to him. At the same time, it was apparently decided to have Dr. Herb Wagner, a renowned fern expert and plant systematist in the Botany Department, team-teach the course with him. Herb had been at the University of Michigan for many years and, in fact, had BVB in his Plant Systematics course when the latter was a student there.

SNR decided to offer a two-semester course sequence in the biology of woody plants, the first semester focusing on their systematic relationships, identification, and ecology, and the second on their physiology. BVB and Herb would

FIGURE 1. Terry Sharik and Burt Barnes fording Meadow Creek in the Monongohela National Forest, West Virginia, June 1966. Photo by Bruce Dancik.

teach Biology of Woody Plants I, and Dr. Bob Zahner, soil scientist and tree physiologist, would teach Biology of Woody Plants II. Thus was born the decision to cover all woody plants—trees, shrubs, and vines. In Biology of Woody Plants I, Herb delivered the lectures on systematics, and BVB the ones on ecology and distribution. The emphasis was on basic processes, using various species as examples, as opposed to the traditional systematic coverage of genera and species within genera. I followed this approach in my teaching for decades at four different academic institutions after leaving SNR.

So off the three of us went in the summer of 1965, scouting field sites for the labs, almost all of which took place outdoors and most in wildland settings. Herb had clearly spent a lot of time in the field and knew all the special places that were relatively undisturbed and that harbored plants that were relatively rare. The range of sites and ecosystems was impressive. Herb loved rare and different things in nature (especially plants and butterflies), and his enthusiasm for them was very contagious. In fact, Herb was by far the more flamboyant of the two of them, including in the classroom where he was always doing outrageous things to get students interested in plants. As I reflect back, it seems possible that subsequent remarks by Burt's students about his "elaborate skits, schemes, and jokes" had their origins in Herb, and I wonder if they were perhaps not magnified following Herb's death in 2000. One also wonders how much of an influence Herb had on Burt's exclamation of "too much" upon observing something interesting in nature. In any case, we developed a woody plant species list for each of these sites, and I then produced lists of the distinguishing characteristics of the

species and descriptions of their natural and cultural history. I recall subsequent teaching assistants in the course, of which there were many, telling me that they continued to use my notes over the years.

I had originally intended to leave SNR upon completing my Master's degree in the spring of 1966, and in fact was offered a job in the Boundary Waters Canoe Area in northern Minnesota, but Herb and BVB gave me the hard sell to stay on and do a Ph.D. degree in forest botany. I agreed, and completed my doctorate in 1970. During that time, I served as the only teaching assistant in the Biology of Woody Plants course. In subsequent years there were multiple teaching assistants in the course as it grew in popularity.

My main objective in this piece was to recount the early history of the Biology of Woody Plants I course in SNR and BVB's role in that course. I might have talked a lot more about BVB the person, but I already covered this to a considerable degree in my remembrance of him in a memorial that I wrote and published in the *Journal of Forestry* in November 2014 (volume 112, no. 6, pages 623-624). Other special memories include chasing dark-barked birches (*Betula* spp.) with fellow graduate student Bruce Dancik ("BPD") and BVB in the Appalachians and the Lake States (Figure 1), and sprinkling aspen (*Populus* spp.) pollen, to which BVB was allergic, in his brief case. We always referred to each other by our initials (BVB, TLS, and BPD), a practice that originated with BVB, who liked to keep things short in his communications, which always ended with "Later, BVB."

In closing, I might add that BVB and I had a wonderful relationship that continued throughout the years until his death. There is clearly a part of me that is missing with him gone, but he lives on in me and in the numerous other students he taught and mentored. And so, it is time to sign off.

Later, TLS

BURT AS I SAW HIM: 44 YEARS OF FRIENDSHIP AND MUTUAL RESPECT

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Burt Barnes was my friend and professional associate for 44 years. Burt loved trees. The southern Illinois farm country, where he grew up, had a significantly better summer comfort level in the shade of his hometown's street trees than in the surrounding countryside. This did not escape the attention of young Burton in the days before air conditioning and when children were free to spend their summer vacations roaming the neighboring landscape. Perhaps the shade trees of his youth influenced his decision to become a forest ecologist. It might also account for the fact that he did not become a traditional forester, with a focus on the sustainability of forest products. Burt was an inquiring student of the biology, life histories, ecological settings, and broad landscape associations of all tree species. As a charismatic teacher, he mentored hundreds of students and inspired them to broadly expand their concept of the elements of forest science.

I met Burt in 1968, shortly after he had received tenure at the University of Michigan's School of Natural Resources. I was a graduate student, studying plant ecology in the Botany Department. Burt had been collaborating with botany professor W.H. Wagner, Jr., to upgrade a traditional dendrology course into a more rigorous version in which all woody plants were included and with emphasis on ecology and field identification (the course would become "Woody Plants"). One field instructional difficulty was with the common local species of ash trees (*Fraxinus* spp.), which exhibited taxonomic differences and site preferences inconsistent with published material. Since I had not yet set up a doctoral committee, Dr. Wagner recruited me to take on the problem. Although I had not even met Burt and was in a different university department, my faith in Dr. Wagner's advice was richly rewarded. Dr. Barnes became co-chair of my doctoral committee and my primary project manager. I joined Burt and his first two doctoral students, Terry Sharik and Bruce Dancik, at the University's new Matthaei Botanical Gardens, where Dr. Wagner was Director. We shared Burt's large lab and filled the research greenhouse with seedlings of the hybrid aspen Burt was studying at the time (*Populus* ×*smithii*), Bruce and Terry's black and yellow birches (*Betula lenta* and *B. alleghaniensis*), and my ash trees.

At the time, I was an unusual student for a forestry professor. I was a local housewife with four children (three of them teen-aged), my undergraduate degree was in chemistry, and my new professor was only three years my senior. One might have expected difficult personal adjustments. Burt, however, was a man who easily built relationships of mutual respect with a great diversity of personalities. Bruce and Terry had dubbed him "BVB," and he greatly enjoyed

being addressed as such by any student in a setting where students usually addressed their professors as "Dr." "BVB" made sure I was given in-depth instruction in forest genetic methods; then he turned me loose to investigate my thesis problem using elements and ideas from both our backgrounds. Over his long career, this fundamental approach, with respect for the intelligence and good judgment of serious students that enabled them to investigate scientific problems independently, has undoubtedly been a vital ingredient in the development of the many highly recognized scientists that Burt mentored at the University of Michigan.

Burt's family was an integral part of his academic life. Although his wife Dixie had her own career as a physical therapist, she was both a hostess and a group member at the many pot-luck gatherings at their home. All of Burt's graduate students and teaching assistants—not to mention any former students or TAs in the neighborhood—were invited. His son and two daughters also participated. As the years went by, special get-togethers were staged to include former students who happened to be in town, and they took on the flavor of family reunions. Dixie also had fantastic editorial skills, and she spent long after-hours time in their home office working with Burt on publication drafts. In later years, with the new challenges of digital publication, Burt's daughter Ginny became his technical assistant. Ginny and her family lived next door, giving Burt and Dixie the joy of close contact with growing grandchildren.

Burt developed important new undergraduate field courses. The Woody Plants course, cross-listed with the Department of Botany, was a huge success and drew large classes, each with several field sections, and he continued to offer the course annually with Herb Wagner throughout their long careers. Initially, Herb was the charismatic lecturer, trading off with Burt, who was a more serious and detail-oriented teacher. Over the years, Herb's lecturing techniques rubbed off on his former student and now teaching colleague. Burt developed a unique showmanship style, often entertaining his audience with inventive illustrations that drove home important concepts. His Forest Genetics course incorporated all the material he had taught me, along with interesting lab exercises, such as preparing fresh meiotic figures of the chromosomes of northern white cedar (*Thuja occidentalis*) in the middle of the winter. This course expanded in content and was eventually replaced by "Forest Ecology," which used the textbook of the same name he had co-authored with his former advisor, Steven H. Spurr. That course became a strong follow-up to Woody Plants and was a standard feature of the curriculum, and versions of it were widely used elsewhere across the country in forestry education.

In addition to the usual class field trips in the Ann Arbor area, Burt led many regional excursions for his courses. While I was still working on my thesis, I was often invited to tag along. The long drives with vans full of students led to lasting personal bonds among the students and between students and their instructor. Burt was always interested in contemporary student culture, and the students were there to fill him in (between Burt pointing out exciting roadside tree sightings). Once, when we were riding to the US Forest Service Northern Research Station in Rhinelander, Wisconsin, with the Forest Genetics class, while Burt and I were comparing memories of our youthful experiences growing up during

FIGURE 1. Burt Barnes pollinating aspen flowers at the University of Michigan Botanical Gardens as part of his aspen hybridization research, March 1968. Burt wore a mask to aid with his strong allergies to aspen pollen. Photo by Bruce Dancik.

World War Two, the van hit a pool of water which must have contained aspen pollen. Burt had developed a strong allergy to aspen pollen when he was conducting aspen hybridization research (Figure 1). His violent reaction while driving was quite disabling, but he managed to pull over, swallow a capsule, take a break, and drive on, all the while discussing various aspects of plant allergies with the students. Our tour of current Forest Service aspen research was interesting, but I'm sure everyone in the group found the ride there much more instructive and memorable. The most popular and often-repeated regional excursion he conducted was to the Great Smoky Mountains National Park in late October (Figure 2). Viewing old growth forest communities in scenic valleys in fall color and hearing firsthand observations about tree species and ecosystems that do not occur in Michigan was a treat for all. The usual van camaraderie, occasional minor mishaps, and class adventures left treasured memories of college days in the minds of many.

Burt kept track of the careers of former students and frequently interacted with their work. In the late 1970s and early 1980s, I coordinated the State Endangered Species program for the Michigan Department of Natural Resources. Burt invited me back to the University to showcase the program through guest lectures in his courses and as a speaker at special occasions at the School of Natural Resources. When I switched to a field position in Mio, managing wildlife habitat within the breeding range of the endangered Kirtland's Warbler, Burt took an interest in my questioning the then narrow characterization of Kirtland's warbler habitat. He and his students cooperated with the Forest Service to analyze a landscape that had been burned by the large 1980 Mack Lake Fire. Their work began in 1986 by a Master's degree student (Xiaoming Zhou) and an undergraduate student (Corrina Theiss) and was continued throughout the 1990s by Master's students Dan Kashian, Wayne Walker, and Glenn Palmgren. Using Burt's published multi-factor system of landscape ecosystem mapping, his students were able to conduct groundbreaking research on the variations of ecosystem structure suitable for regenerating jack pine communities that would become

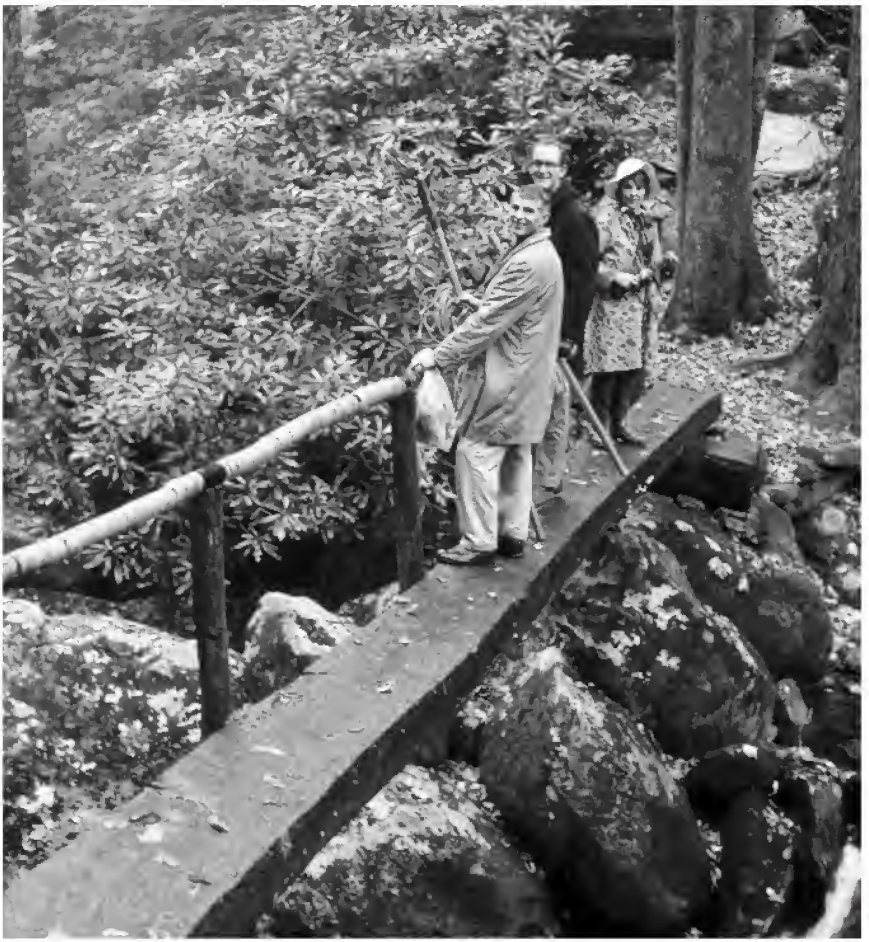

FIGURE 2. Burt Barnes, with pole pruner and bag of plant collections, and students on the trail to Ramsey Cascades, Great Smoky Mountains National Park, October 1969. Photo by Bruce Dancik.

Kirtland's warbler habitat. This kind of continued engagement with many of his former students and colleagues has been very productive and has knit together a broad band of scientific thinking.

Although Burt was ordinarily a very conservative spender, there was no financial barrier to his obtaining the best German cameras (Figure 3). He took them on his world-wide forest research projects and brought home stunning slide shows. I still treasure the postcards he sent from his trips. They typically had beautiful local forest scenes on one side and a finely printed full-length letter on the other. As one of the first post-Cold War American scientists to work in China, he set a favorable example for the welcome of those to follow and made lasting

FIGURE 3. Burt Barnes taking photographs from the top of a University sedan, July 1966. Photo by Bruce Dancik.

friendships among Chinese foresters. His last overseas project before his retirement was with a Japanese graduate student, Ikuyo Saeki, whose dissertation compared the endangered red maple of Japan (*Acer pycnanthum*) with various North American red maples. Burt toured Japan with her to evaluate its native habitat. Back at the University, Ikuyo's studies suggested that the closest North American match was likely a subspecies of red maple in the southeastern US coastal wetlands that was known as Drummond's red maple (*A. rubrum* var. *drummondii*). Burt and Ikuyo then embarked on a collecting trip wading in swamps throughout the South. They ended up at my sister's place in the Big Thicket region of southeastern Texas, near the Louisiana border. There, good representative trees were growing in the front yard and around her two ponds. It turned out to be a very enjoyable visit with important collections, an established outpost for future studies, and a comfortable finish to the foray. Dr. Ikuyo Saeki is back in Japan, still in touch with Burt's family, and studying red maple on Hokkaido Island.

I retired from the DNR in 1991. Burt needed me that year as his sabbatical re-

placement to teach Woody Plants. Next he asked me to partner with his student and assistant Mel Gunn as she established a course in Spring Plants and Ecosystems. He also gave me his space at the Botanical Gardens so I could resume my *Fraxinus* research. Although I followed his lead to a point, and still have an active involvement with the University, my days in public service had turned many of my interests elsewhere. Nevertheless, we still engaged in lively telephone debates (he never did convince me that you could draw an edge around an ecosystem), I occasionally collected plants for him, he used the back of our five-acre lot to store research tree seedlings, and we exchanged Christmas family newsletters. After his retirement, Burt sometimes joined the now traditional Friday evening (low-end) restaurant dinners that Ed Voss used to orchestrate as end-of-week get-togethers with staff and friends from the University Herbarium. Here Burt became socially acquainted with Tony Reznicek, a supporting collaborator during Burt's weekly herbarium visits. The Herbarium provided Burt with ready material to examine an array of shrub specimens as he pursued his quest to finish an authoritative "Shrubs of Michigan" book before he was overtaken by medical issues. Burt, after all, was as much a botanist as a forester.

KNOWING THE TERRITORY: LANDSCAPE ECOSYSTEM CLASSIFICATION AND MAPPING

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Burton V. Barnes was a pioneer of ecological land classification in North America. Since he first introduced integrated, multi-scale, multifactor landscape ecosystem theory and methodology at the University of Michigan in the early 1980s (e.g., Barnes et al. 1982), ecological classification and mapping has become widely accepted as a "best practice" in ecosystem and biodiversity conservation and sustainable resource management. Numerous other systems have been developed and are in use (e.g., state natural community classifications), but the methodology that Burt honed and taught likely remains the one that is most true to nature in describing and documenting the hierarchically nested, volumetric ecosystems of specific locales and regions. In the Barnes method, each classification is discerned from the ground up, based on the combination of climate, landform, geology, soils, and hydrology.

Burt first encountered multifactor, ecoregional mapping in the southwestern German state of Baden-Württemberg, an area of extremely diverse climate, geology, and soils (Barnes 1996). There, in the 1940s, interdisciplinary teams began integrating geology, climate, soils, and vegetation in their classification systems and maps (Schlenker 1964, Mühlhäusser et al. 1983). At the local scale, they introduced the concept of ecological species groups, each of which consists of several plant species found growing in similar environmental conditions, thereby using repeating patterns of groups of species, rather than individual indicator species, to help in detecting ecological differences across the landscape (Schlenker 1964, Sebald 1964). After encountering this approach to forest ecology in Baden-Württemberg, Burt spent a great deal of his career studying and promoting landscape ecosystems as a means of understanding the spatial patterns of and the functional interrelationships in forest ecosystems. He loved learning about forest landscapes in this way, not only for an intrinsic understanding of the fascinating nuances seen in such patterns and interrelationships, but also for improving the management and conservation of such ecosystems. He also loved sharing this way of reading the landscape with the thousands of stu-

dents he taught and the many others he reached through his writings and presentations. Those of us who were with him in the field continue to hold an image of Burt carrying a long-handled shovel and wearing his cruiser's vest. (Of course, when collecting aspens he traded the shovel for a pole pruner!)

Soon after the inception of ecological land classification in Germany, J. Stan Rowe, a Canadian ecologist, also began promoting a hierarchical concept of ecosystems and its application to forestry (Rowe 1961, 1962). Burt, a like-minded colleague, became a close friend of and collaborator with Dr. Rowe; they corresponded for decades, interchanging ideas and separately promoting an understanding of geographically-based ecosystems that exist hierarchically at multiple spatial scales (e.g., Rowe and Barnes 1994). They taught, wrote, and spoke about how, through multifactor, integrative research at both large and small scales, landscape ecosystems can be classified and mapped and the classification applied to the establishment of improved management and conservation practices. This approach, although altered to a lesser or greater extent by different researchers, has had a large influence on the way ecologists and conservationists have studied and understood landscapes.

In the early 1980s, Burt introduced the landscape ecosystem approach to his graduate students at the University of Michigan's School of Natural Resources and Environment (SNRE). Barnes and his students classified and mapped landscape ecosystems by distinguishing the landforms (or physiography) of the local landscape and studying their interrelationships with the topography, soils, and microclimates. Burt taught that in the landscape ecosystem approach vegetation is a phytometer that helps us see ecologically meaningful differences in the landscape (Figure 1). Landscape ecosystem classification and mapping thus differs substantially from vegetation classification and mapping; in the former, the place—its landform, landscape position, meso- and micro-climate, topography, soils, and hydrology—is primary. Burt wrote in *Forest Ecology, 4th edition*, "Ideally, we would like to delineate and map landscape ecosystems by integrating all these components on all [geographic scales]. Although desirable, this formidable task has not yet been accomplished except at the local or micro level" (Barnes et al. 1998, p. 24). The application of this approach to the "local level" to which Burt referred was initiated in the United States in Michigan, where he and students first classified and mapped local landscape ecosystems of old-growth forests within the Ottawa National Forest in Michigan's Upper Peninsula. The work was done initially in the McCormick Experimental Forest (Pregitzer and Barnes 1984) and then in the Sylvania Wilderness Area (Spies and Barnes 1985). The classifications that resulted from these studies consisted of detailed maps and site unit descriptions, the latter of which included designation of ecological species groups, detailed landscape cross-sections showing slope and soil type, and vegetation diagrams.

Additional ecosystem classification and mapping of local landscape ecosystems was subsequently completed for the Huron Mountain Club Reserve Area (Simpson et al. 1990), the University of Michigan Biological Station (UMBS) (Lapin and Barnes 1995; Pearsall 1995; Pearsall et al. 1995; Zogg and Barnes 1995), the Mack Lake burn and associated glacial outwash plains of northern lower Michigan (Zou et al. 1992, Kashian and Barnes 2000, Kashian et al. 2003,

FIGURE 1. Burt Barnes and graduate student Lloyd Simpson in the field using a sampling frame to quantify ground cover for landscape ecosystem sampling and mapping, 1981. Photo courtesy of the Burton V. Barnes estate.

Walker et al. 2003), and other areas (Figure 2). At the UMBS, three hierarchical scales of landscape ecosystems were mapped—major landforms, minor landforms, and local ecosystem types. The UMBS landscape ecosystem team identified 125 local ecosystem types (Figure 3); subsequent researchers have em-

FIGURE 2. Burt Barnes leads a discussion about landscape ecosystems in the field with land managers near Mio, Michigan, July 1996. Photo by Dan Kashian.

FIGURE 3. Burt Barnes (right) with the field crew mapping landscape ecosystems at the University of Michigan Biological Station, 1991. Graduate students from left to right include Gregg Zogg, Doug Pearsall, Lance Cablk, and Joanne Constantinides. Photo by Sandy Beadle.

ployed the classification and maps developed for the UMBS landscape as a framework for studies of bird populations (Dietsch 1995), net aboveground primary production (Dronova et al. 2011), and habitat distribution of small mammals (Sato 2007). Current researchers are studying the changes in plant community composition and diversity in multiple strata over a 25-year interval and assessing the influence of landform and ecological properties, including soil nutrients and moisture, on the observed changes (Raleigh Ricart, pers. comm.).

After the first ecosystem mapping of local landscapes in the Upper Peninsula was completed, two of Burt's other graduate students undertook large-scale landscape ecosystem classification and developed a state-wide regionalization of Michigan in the 1980s. Shirley Denton analyzed and mapped thirty years of climatic data, and Dennis Albert synthesized bedrock geology, glacial geology, and soils; together they synthesized their analyses into a single regional landscape ecosystem classification and map (Albert et al. 1986) with descriptions of landforms, soils, and vegetation for each large-scale ecosystem. Following the Michigan regionalization, Albert initiated a three-state ecoregional map and classification in collaboration with the US Forest Service and the Minnesota and Wisconsin Departments of Natural Resources (Albert 1995). In this three-state regionalization, Albert attributed details on bedrock and glacial geology, lake and stream characterization, forest or prairie type, and prevalent rare plants and animals to each map unit. An early draft of the three-state regionalization in-

spired US Forest Service ecologists to revise Bailey's broad-scale ecoregional map of the United States (Bailey 1983) to include finer sub-units (McNab and Avers 1994).

Burt participated regularly in all of these landscape ecosystem projects in reconnaissance and plot sampling and in the development of the maps and classifications. We and other former graduate students fondly remember jointly discovering—and sometimes vigorously debating—the patterns of relationships among landforms, soils, and vegetation. Burt was ever sharp of mind, and he was passionate about continual improvement in the concepts and products of our work, knowing that they would be used and tested by future researchers and managers.

An important advantage of the regional landscape ecosystem maps (Albert et al. 1986, Albert 1995) was their utilization for natural resource management and restoration decisions in Michigan. The Michigan Department of Environmental Quality uses ecoregions as the basis for wetland mitigation; the Michigan Natural Areas Program created a natural areas map that was overlain on ecoregions and made recommendations for additional dedications of natural areas and based native plant seed zones on ecoregional boundaries. The Nature Conservancy in Michigan (TNC) initiated a bioreserve protection program in the early 1990s in which the proposed bioreserves were identified within an ecoregional framework; inventories for the proposed bioreserves were conducted in the mid-1990s (Albert et al. 1995). The Michigan Natural Features Inventory and TNC initiated an ecoregional planning project in 1994 to identify and develop conservation strategies for ecologically important sites and to prepare inventories for them. Just before he retired from SNRE, Burt himself was engaged by TNC in 2005 to contribute to conservation planning for two regional landscape ecosystems in southeastern Michigan, and he then mentored a team of SNRE Master's students working with TNC to develop a conservation plan for the Grayling Outwash Plains, an ecoregional subdistrict in northern Lower Michigan (Muladore et al. 2006). True to form, Burt participated in field reconnaissance and meetings with TNC and partners throughout these planning processes (Figure 4), and would be thrilled to know that public land managers including the US Forest Service, the US Fish and Wildlife Service, and the Michigan DNR, as well as other conservation organizations, such as Huron Pines, continue to use the Grayling Outwash Conservation Plan to guide management and restoration decisions.

The use of a regional landscape ecosystem framework at a continental scale was fully embraced by TNC, which in the late 1990s had developed a system of ecoregions (The Nature Conservancy 1996) based strongly on the ecoregions developed by Bailey for the US Forest Service (Bailey 1995), as well as on work by Olson and Dinerstein (1998) and Environment Canada (Wiken et al. 1989). Using this ecoregional framework, TNC has identified priority areas for biodiversity conservation throughout North, Central, and South America and other regions. In other larger scale work in Michigan and other states, state-wide regional classifications were followed by more localized Land Type Association (LTA) mapping. LTA mapping delineates map units between the regional scale of the statewide maps and much smaller local units, providing a middle scale in the nested ecosystem hierarchy. Descriptions of the LTAs included information on original and current vegetation and on the associated rare plants and animals

FIGURE 4. Burt Barnes and graduate students at a jack pine barren in northern Lower Michigan, May 2005. Left to right: Rebecca Schille, Burt Barnes, Stephanie Pendergrass, and Jennifer (Stover) Muladore. Burt advised a Master's project that developed a conservation plan for the Grayling Outwash Plains for The Nature Conservancy. Photo courtesy of Jennifer Muladore via University of Michigan School of Natural Resources and Environment Flickr page under a Creative Commons Attribution 2.0 Generic license; desaturated from original; original at www.flickr.com/photos/snre/14611740392/.

(Corner and Albert 1999a, 199b, 1999c, 1999d, 1999e, 1999f). The landscape ecosystem approach has not been limited to Michigan, nor have Burt and his students been the only practitioners to employ it. In Vermont, statewide LTA mapping within the eight biophysical regions of the state was contracted to outside ecologists (Ferree and Thompson 2008) and was used in the state's forest resource planning (Vermont Forests, Parks and Recreation 2010). Also in Vermont, a landscape ecosystem approach was used in mapping and classifying lands of a large-landscape conservation project (Lapin and Engstrom 2002), and it aided in delineating state-land ecological reserve boundaries.

Burton V. Barnes has left a powerful legacy in his landscape ecosystem classification and mapping work. Thousands of students were introduced to Burt's rigorous method of integrating climate, physiography, soils, and vegetation to understand landscapes in a new way. Many went on to utilize landscape ecosystem theory and practice in their professional work, and many more encountered the approach through literature, professional meetings, or colleagues. In both direct and subtle ways, the impact of Burt's teaching and research and the application of his multi-scale, multifactor landscape ecosystem classification have left

an imprint on present and future generations in their understanding of the Earth's ecosystems from local places to continental scales.

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BURT BARNES'S INFLUENCE ON FOREST MANAGEMENT IN MICHIGAN

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Burt began his career at the University of Michigan in 1964 as a professor of forestry. Like many forestry professors of the time, he was expected to have background knowledge of silviculture and forest management, and he was asked to teach various courses in those areas. Throughout his career Burt considered these fields to be interesting and particularly necessary to understand for the sake of interpreting and studying forest history and investigating how ecosystems responded to past activities. But they were not his passion; he was more interested in natural areas than heavily managed areas and in understanding ecosystems rather than manipulating them. He cringed at clearcutting but marveled at the ability of a forest ecosystem to respond to it.

Burt saw that his world view—that landscape ecosystems, consisting not only of species, but also of systems of climate, soil, and landforms, should be the focus of study and management rather than species alone—could be realized as agencies such as the US Forest Service (USFS) and the Michigan Department of Natural Resources (MDNR) moved more towards natural areas management beginning in the 1980s. Burt and his students had begun to develop detailed ecological classifications of pristine landscapes in Michigan's Upper Peninsula, for example at the Huron Mountain Club, Sylvania Wilderness Area, and the McCormick Experimental Forest, but he quickly thereafter began to pursue the development of such a classification system across large areas of public land. He began to push his ideas about landscape ecosystems and ecological classification more strongly to the USFS, and his basic approach and ideas facilitated the classification and inventory system that was developed for the Huron-Manistee National Forests (HMNF) in the early 1990s. Burt's graduate students also worked to develop local classifications of riparian ecosystems, wetland ecosystems, and old-growth forests during the 1990s. Moreover, the current Hiawatha Forest Plan, which guides all management activities on the Hiawatha National Forest, uses elements of Burt's ecological classification system as a basis for determining natural successional pathways and for prescribing appropriate silvicultural treatments. He

was a pioneer in bringing a landscape ecosystem approach to the United States and the USFS, and his approach to developing hierarchical ecological site classification systems continues to be used by USFS managers all across the country.

Burt was also interested in old-growth forests in Michigan and hoped to assist USFS and MDNR managers in the process of old-growth designation. Burt advised a group of graduate students at the University of Michigan's School of Natural Resources on a master's project in the mid-1980s that examined in detail a tract of old-growth red pine (*Pinus resinosa*) on state-managed land in Crawford County. Burt was also a consultant in the 1990s for the old-growth team on the HMNF, where he helped to identify the appropriate mix of forest types incorporated into the HMNF old-growth design, and he lent his insight to the formulation of old-growth management guidelines. Today, 173,000 acres of the HMNF is designated as old-growth forest.

Perhaps Burt's longest-lasting influence on both the USFS and MDNR was how he approached the management of the federally endangered Kirtland's warbler. Since Kirtland's warbler is highly dependent upon jack pine (*Pinus banksiana*) forests of a specific structure and age, using forest ecology and management to manage warbler habitat on National and State Forests is critical in recovering the species. At the urging of one of his former students, Dr. Sylvia Taylor, who at that time was with the MDNR, Burt began to apply his landscape ecosystem approach to this endangered songbird in the late 1980s to understand and predict warbler occurrence across the 1980 Mack Lake Burn on the Huron National Forest. Working with the USFS beginning in the mid-1980s, he and a team of students developed an initial ecological classification of the burned landscape that showed the range of landscape ecosystems used by the warbler and that demonstrated how understanding those ecosystems could aid management. This work was continued by Burt and additional graduate students throughout the 1990s and continues to be influential today. When the Kirtland's warbler population began to expand into the Upper Peninsula in the late 1990s, Burt dispatched graduate students to meet with one of us (SJS) near Manistique to view Kirtland's warbler habitat in the Upper Peninsula, take some soil samples, and discuss research and management opportunities for Kirtland's warbler there. It was one significant step that eventually led the Hiawatha National Forest to treat Kirtland's warbler habitat as a strong consideration in its management strategy for jack pine ecosystems.

Of course, the lifelong relationships that Burt developed with his students—both undergraduate and graduate—helped him to influence forest management in Michigan, particularly when those students themselves became influential in forest management (Figure 1). Two of the authors of this report (SJS and PWH) were former undergraduate students of Burt's at the School of Natural Resources who found careers in the USFS and who helped to incorporate his work and ideas into that agency.

(*Stephen Sjogren*)

I was a fledgling forestry student at the School of Natural Resources when I first met the dynamic Dr. Barnes on the first day of Woody Plants in the fall se-

FIGURE 1. Burt Barnes conducting a soil texture-by-feel test with Phil Huber (striped shirt, center), Steve Sjogren (behind Barnes, left) and other US Forest Service forest and wildlife managers near Mio, Michigan, July 1996. Photo by Dan Kashian.

mester of 1976. It was a time when forestry, nature, and natural resource management all came together and began to emerge into a passion and a life calling for me. Over the course of that semester I spent long fall afternoons with my fellow students and Burt, trekking across various woodlands in the Ann Arbor area, learning about the diversity and habitat relationships of several hundred plant species. Burt had a special way of making these field trips fascinating and fun, generating a sense of importance in knowing the flora, and perhaps more importantly, why a species grows where it does. I was so excited by the class and Burt's approach to teaching that I really felt I was where I was supposed to be, learning forestry and forest ecology from the best. This semester with Burt launched my 34-year (and counting) natural resource management career.

But Burt's influence on me was not just through his courses. Our paths were to cross again several years after I graduated. In the early 1990s I was working as a wildlife biologist for the Hiawatha National Forest, and I was thrilled to see Burt at a Kirtland's Warbler Recovery Team meeting in Grayling. He had a wonderful knack for building a bridge between research and management and strove to inform resource managers with meaningful research. His communication style showed how well he understood the challenges of applied science and resource management. Even now, Burt's influence on me, and on many other biologists, botanists, and foresters, continues. Over my career as a resource manager, first in forestry, then in wildlife, my time with Burt left me with a clear understanding that ecosystems are bigger than the sum of their individual parts and that indi-

vidual ecosystem components are interdependent. I have tried to maintain a holistic ecological approach to management over the course of my career. Burt's mentorship prompted me to devote my life to working in the woods and fields of northern Michigan and to building a career around ecosystem management.

(***Philip Huber***)

Similar to Stephen's experience, my first encounter with Burt was in Woody Plants at the School of Natural Resources. Like most students, I didn't know what I wanted to do with my life and was not enjoying the slew of required courses I was taking. In Woody Plants, I remember being quite surprised at how unconventional his lectures were, particularly his informative and amusing slide shows of his adventures in various parts of the US—beautiful places that I had never been to or even knew existed. His presentations were interesting and inspiring and always incorporated humor. In the field, he would travel with his students and take the time to make sure they understood the ecological relationships between the soils and the trees growing on them . . . by digging six-foot deep holes wherever he went. In forest ecology I had finally found a subject I was actually interested in, an expert in the subject matter, and a professor who had a sense of humor and who made learning fun. I was hooked on Burt and what he had to say. His passion and excitement were contagious.

After graduating from Michigan, I started working for the USFS on the HMNF. I was fortunate to continue to work with and learn from Burt throughout my career and to work with his graduate students in the Mack Lake Burn area. After a long career as a wildlife biologist for the USFS, I realized that what I know, believe, and love about forests, wildlife, and forest management came from that grey-haired man and his holistic vision of the natural world. With ever increasing demands on our forest ecosystems, I will continue to practice and preach forest ecology according to Burt.

BURTON V. BARNES AS A FOREST BOTANIST

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A cornerstone of Burt Barnes' many contributions to forest botany is the well-known and critically acclaimed course known simply as "Woody Plants." Created in 1965 with Burt's mentor and botanical colleague, Dr. Warren "Herb" Wagner, Jr., and Terry Sharik, then a Graduate Fellow (see Sharik, *this issue*), the course's roots trace to a long-standing, entry-level dendrology class. Previously taught primarily to undergraduate forestry students, the dendrology course was formulaic and limited in scope (as well as reportedly quite tedious). Barnes and Wagner used their new course to reframe forest botany and revitalize its pedagogy with many teaching innovations. Their creativity in organization and instruction vastly broadened the course's appeal and the size and diversity of its audience. In the mid-1970s the course was designated as a university-wide course and accommodated as many as 200 students per term. Many middle-aged Ann Arbor residents fondly tell of taking the class when they encounter current Woody Plants students in the field.

A critical element in the evolution of Woody Plants was fusing the particular specialties that Barnes and Wagner each brought to the course, providing a unique combination of ecological and organismal knowledge delivered via a carefully planned, tag-team teaching format. Herb, a National Academy of Sciences member known widely for his research on pteridophyte systematics, provided the botanical foundation students required. He began the course with several lectures on plant terminology and morphology, then methodically expanded on this to introduce more complex botanical topics such as plant variation, hybridization and introgression, pollination biology, and systematic relationships. At well-chosen intervals Burt lectured, building the ecological underpinnings of Woody Plants by explaining the processes of establishment, competition, succession, and natural disturbance as key ecological components necessary for ecosystem function. Burt then discussed the dominant forest ecosystem types of Michigan, later ranging into forests found elsewhere in North America. Included were lectures on forest ecosystems of the Appalachians, the southeastern Atlantic Coastal Plain, and the Sierra Nevada and Rocky Mountains of the western

United States. The purpose of lecturing on non-Michigan forests was not merely for perspective, but was also by design, since Burt knew that some students would eventually work in these areas. It was thus not atypical for former students to contact Burt Barnes to express their gratitude for the introduction to these landscapes, which helped to orient them in their new "home place." Woody Plant students that continued on into Burt's highly regarded Forest Ecology course (and beyond) would later have the lesson firmly driven home about the need to "know the territory." This was perhaps the unifying concept embedded in all of Burt's teaching efforts over the years.

Burt's Woody Plants lectures were not restricted to purely ecological topics, owing to his strong background in forest botany and the related topics of forest genetics, silviculture, and plant physiology. He lectured on the processes of germination, flushing, growth, reproduction, and dormancy, and on related topics such as frost-freeze tolerance and its effects on range limitation. In addition, Burt artfully incorporated specimens into his lectures, taking particular pleasure in introducing, for example, the southern and western conifers of North America. The latter was the source of a mild ruse, in which Burt displayed the cones of several western conifers putatively leading up to what would be expected as the enormous cones of the continent's largest trees, *Sequoia sempervirens* (coastal redwood) and *Sequoiadendron giganteum* (giant sequoia), the set-up being the penultimate demonstration of the enormous cones of *Pinus lambertiana* (sugar pine) and *P. sabiniana* (digger pine), and especially *P. coulteri* (Coulter or big-cone pine). The actually diminutive cones of coastal redwood and giant sequoia were stored in large grocery bags and revealed last, to the surprise of some and much to the amusement of the graduate student instructors familiar with this skit.

When he initiated active research in China in the 1980s, Burt also began to incorporate a Woody Plants lecture on vicariant species of eastern North American and eastern Asia, a well-known research topic in phytogeography. This presentation was given toward the end of the course, when students would not only appreciate and better understand the topic but would also apply their newly developed plant identification skills. Using specimens collected during his field research in China, Burt presented examples of vicariant species pairs. This made a lasting impression, since it showed students that they were able—through their woody plants training—to detect the similarities and differences between related taxa with widely disparate distributions. The species pairs included the North American *Liriodendron tulipifera* (tulip-tree) and its Asian counterpart *L. chinense* (Chinese tulip-tree); our native *Sassafras albidum* (sassafras) and the Asian *S. tsumu* (Chinese sassafras); and several species pairs within the genus *Carya*.

By the time the Woody Plants class had reached its 40th year, it was a complex and highly orchestrated endeavor, with bi-weekly lectures and multiple field trips, indoor and outdoor labs, a student collector, and several graduate student instructors (GSIs). The class had attained an almost folkloric status (Figure 1). The field sites, landscape descriptions, class notes and identification tools provided an enduring template for the continuation of the class. Perhaps most importantly, the Woody Plants class had developed its own teaching culture that Burt's students sustained after his retirement. One of us (CWD) first taught the course as a new faculty member in the Department of Ecology and Evolutionary

FIGURE 1. The Woody Plants class gives Burt Barnes a standing ovation following his final lecture in the course before his retirement, December 2005. Photo from University of Michigan School of Natural Resources and Environment Flickr page under a Creative Commons Attribution 2.0 Generic license; desaturated, cropped, and straightened from original; original at www.flickr.com/photos/snre/14584134446/.

Biology in 2006, and it was staffed with three GSIs who had either taken or taught the class in prior years. The GSIs were well-versed in plant identification and in the pedagogical style used to teach Woody Plants successfully to over 3,000 University of Michigan students. This included engaging students to use creativity to learn idiosyncratic but important identification characters (for example, the species-specific shape of winter buds or leaf scars) and by making students focus on key characters through observation and discussion in the field. Burt ensured that the class was passed seamlessly to new teachers and a new generation of students following his retirement in 2006. Burt wrote pages of emailed notes as a response to any questions the new instructor posed regarding field sites, glacial history, or Michigan botany. A highlight of the course was Burt's annual guest lecture on aspens and poplars (*Populus*), which featured a humorous skit about the race to describe the world's largest organism—an aspen clone in Utah, which Barnes described long before a second group enjoyed fame by writing about it in the journal *Nature* (Grant et al. 1992).

Michigan Trees and Michigan Shrubs & Vines

Central to teaching Woody Plants was the development of a reliable, illustrated woody plants guide for Michigan. No such current, comprehensive Michigan manual existed during the course's early years. For students in the 1960s and

1970s, there were available for identification purposes only guides that either were outdated, had incomplete coverage, or treated too large an area (thereby containing too many extralimital species) such as *The Trees of Canada* by Hosie (1975), Harlow's fruit and twig keys (1959), the tree and shrub guides in the well-known Peterson field guide series, or the available standard botanical manuals. Among the most applicable field guides was the classic *Trees of Michigan* by Charles Herbert Otis, first published in 1915 by the University of Michigan Press and known through subsequent re-issues (see Otis 1931). Although the Otis manual was considerably out of date, it included accurate and elegantly prepared illustrations, of which the original plates had been preserved. It was thus logical that Barnes and Wagner would choose to write a contemporary field manual of trees by extensively revising and building upon the Otis guide. Applying their considerable botanical and ecological expertise, and heavily influenced by the teaching and training needs of numerous students over the years, Barnes and Wagner produced their first version of *Michigan Trees* in 1981. Following a lengthy collaborative revision prior to Wagner's death in 2000, Burt published the expanded *Michigan Trees* in 2004, adding a detailed introduction to the state's ecoregions, ecosystems, and communities, among several other new features. *Michigan Trees* should perhaps be considered the exemplar of all modern woody plant field manuals based on its superb organization and the extensive, reliable information written for a broad audience of users.

By the time Burt retired, he had still not completed his final contribution to the Woody Plants class—a guide to the shrubs and vines of Michigan. During its first decades, the class used Billington's *Shrubs of Michigan* (1949), and later *Shrubs of Ontario*, by Soper and Heimburger (1981). During the initial stages of writing a guide to shrubs and vines in collaboration with Woody Plants lecturer Melanie Gunn, Barnes had assumed that the illustrations in *Shrubs of Ontario* were in the public domain. When this turned out not to be the case, it almost sank the book project. Burt then invited CWD to become an additional coauthor to help push the project to completion. Burt worked assiduously on the selection of published drawings from over 30 books (Figure 2). He also worked with two local artists to supplement the previously published line drawings, and he collaborated with A.A. Reznicek in a review of herbarium specimens in order to distill essential morphological features from a range of variation. How effectively Burt worked with specimens of these complicated plants was eye-opening to AAR. Even in drawings that looked perfectly acceptable and seemed to represent species well, he would immediately see problems. When Burt pointed them out, the problems became clear, and one could then readily see how they could confuse people. It is that incredibly focused attention to detail that made *Michigan Trees* so helpful, and *Michigan Shrubs & Vines* will follow in the same vein.

Burt and CWD met frequently to discuss the shrubs and vines book. In addition to discussing technical aspects, they had wide-ranging conversations on forest history and ecology. This experience had a profound impact on the new instructor's thinking about Michigan forests and teaching approaches, and many of Burt's ideas were reintroduced to the Woody Plants class. Burt left the writing of the preface to *Michigan Shrubs & Vines* to his coauthors and requested only that the book be dedicated to the students of Woody Plants. As is the case with *Michi-*

FIGURE 2. Burt Barnes examining line drawings of shrubs at home for the *Michigan Shrubs & Vines* book, May 2014. Photo by Chris Dick.

FIGURE 3. Burt Barnes studies *Ilex mucronata* at the University of Michigan Biological Station for the *Michigan Shrubs & Vines* book, August 2013. Photo by Dan Kashian.

FIGURE 4. Burt Barnes discusses the ecology of red maple in the field at the University of Michigan Biological Station, June 2005. Photo from University of Michigan School of Natural Resources and Environment Flickr page under a Creative Commons Attribution 2.0 Generic license; desaturated from original; original at www.flickr.com/photos/snre/14627178753/.

gan Trees, the book is much more than a field guide; it is a unified perspective on the ecology, evolution, and history of Great Lakes landscapes as viewed through the lens of shrub and vine natural history.

Emeritus Research and Outreach

Burt's research did not slow down with retirement. Along with his persistent work on *Michigan Shrubs & Vines* (Figure 3), Burt continued to mentor young scientists. For example, Burt worked closely with a post-doctoral student from Japan, Ikuyo Saeki, on studies of Japanese and North American maples (see Makino et al., *this issue*). As an extension of Burt's longstanding interest in forest genetics, he traveled with Ikuyo around eastern North America to sample leaf morphology and genetic variation in red maple, *Acer rubrum* (Figure 4). He invited CWD to collaborate and to host Ikuyo in his lab. Because of Burt's interest in hybridization, the authors expanded the study to include co-distributed silver maple (*A. saccharinum*). The paper by Saeki et al. (2011) on the comparative phylogeography of maples had several important results for the interpretation of North American forest history. First, it showed that the phylogeographic patterns in red maple were strongly influenced by the introgression of chloroplast DNA from the regional gene pools of silver maple. The discovery of interspecific gene

flow in Michigan red maple proved especially important, because the genetic variants (chloroplast DNA haplotypes) in the recently glaciated northern range edge had been previously interpreted as a legacy of cryptic Pleistocene forest refuges (McLachlan et al. 2005). The maple research led to comparative studies of North American birches, which showed similar patterns (Thompson et al. 2015) and to a new awareness of the impact of hybridization on the genetic structure of forest tree species.

In addition to his own forestry-oriented work, Burt maintained many other contacts and commitments in retirement. AAR was surprised once when Burt asked him about German language orchid terminology, and learned that Burt was acting as scientific language advisor for the English translation (INULA 2012a) of an innovative German book on orchids (INULA 2012b)—a continuing legacy from his early work in Germany and yet another example of the breadth of his knowledge and influence.

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ASIA: TOO MUCH!—BURT'S INFLUENCE BEYOND THE BORDERS OF THE USA

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Burt Barnes quietly had an active research program that took place in Asia beginning in the 1980s that is often overlooked when reflecting upon his career, and relatively little is known about his exploits in Asia. Burt was one of the very first western scientists – particularly amazing because he was a field ecologist – to visit China in the early 1980s (Figure 1). His work during these early years was largely exploratory, but was focused upon identifying sister species that were found in North America and China—that is, species similar in morphology between the two continents that clearly descended from a common ancestor. His work took him to extremely remote areas of China, including the Yellow Mountains, all while he was heavily "escorted." Many residents of these rural areas of China had never seen an "outsider" before, and as Burt stopped to interact with the local children—in one photo, giving them balloons—the expressions on their faces showed it clearly. He found these experiences fascinating, and incorporated them into a lecture about China in his Woody Plants class at the University of Michigan, while fully dressed in a Mao-style uniform he obtained during his time there.

Burt returned to China more formally in the mid-1980s and was a Visiting Scientist there in 1984, when he spent four weeks based at the Nanjing Institute of Forestry studying forest ecosystems and Chinese species of *Populus*. Burt was well traveled in China during this period, and his field studies took him to northeast China to examine the major regional ecosystems in the Changbaishan Preserve and to study ecosystem structure and niche ecology in the Korean pine-hardwoods forests there. His focus was on Chinese *Populus* species, of course,

FIGURE 1. Burt Barnes with a new colleague in the field in China, 1982. Photo courtesy of the Burton V. Barnes estate.

and he also made visits to Shenyang and Liaoning Provinces, Beijing, and elsewhere in western China, and to Nanjing. Burt returned to China again in 1992, and he often spoke of the lectures he was asked to give in front of very large auditoriums full of Chinese students anxious to learn about forestry and forest ecology in North America and the United States. The subject of these lectures, more than once, were often "presented" to Burt the night or even hours before he was to give them, including exhaustive topics such as "Forestry in the United States," with only the slides in his tray and the knowledge in his head to depend upon.

Burt's work in China in the middle 1980s spurred much interest from Chinese graduate students, and he hosted several of these students at the School of Natural Resources and Environment (SNRE) at the University of Michigan. He also developed a lifelong friendship and professional relationship with Fujing Han – known by his domestic graduate students simply as "Mr. Han." Mr. Han often

spent many weeks at a time in the United States and at the University of Michigan working with Burt on various Chinese forest ecology projects, and Burt at several points helped members of his family to enter and stay in the United States. Burt also hosted several distinguished Chinese professors at SNRE in the mid-1990s. It was this background work in China, in part, that led Burt to develop a particular fondness for working particularly closely with graduate and undergraduate students from Asia and Europe throughout the remainder of his career.

(*Yuka Makino*)

I met Burt in 1992 as a Master's student at SNRE. I came to Ann Arbor from Japan with an undergraduate degree in international environmental law but was determined to embark on a Master's degree in terrestrial ecosystem management. There was no turning back after I took Burt's Woody Plants class and was thrown into his wonderful, fascinating world of soil pits, roots, seeds, and twigs. I had to spend four hours a day in the lab to catch up to the same level as my fellow graduate students who had done forest ecology as undergraduates, but the guidance of Burt and Professor John Witter, who had taken me on as his advisee, saw me through. In 2005, I had the honor of becoming Burt's final Ph.D. student.

Burt connected with international students who attended SNRE at an extremely deep level. His passion for teaching was unquestionable; what distinguished him was his passion of ensuring that the students actually learned. He expected excellence, but went out of his way to help you achieve it. There happened to be several Japanese M.S. students at SNRE during this period, and Burt held periodic tutoring classes for them in his Woody Plants class to make certain that the students understood the concepts. At a more personal level, he helped me fill the gap of 13 years between my M.S. and Ph.D. and used his own time to tutor me twice a week on forest ecology so that I could take my preliminary exams during the first year of my Ph.D. work.

Burt bent over backwards to support his students. Burt was one of the few professors that was willing to take on a student like me who wanted to conduct her Ph.D. research in a remote village in the Indian Himalayan Mountains at an elevation of 2,500–3,000 meters. My research focused on how people use forest resources and how that affected the regeneration capacity of the pine-oak (*Pinus–Quercus*) forest of the Central Himalayas. The research was to determine the validity of the predominant view that the villagers' forest-use was exceeding the carrying capacity of the forest and destroying it. Though my research eventually proved that view wrong and demonstrated that the forest continued to regenerate, it involved living in the village without electricity and running water for a total of eight months and walking for several hours to go to the forest with the villagers every day from 7:30 am to 6:00 pm. I measured the diameter of every tree they climbed and of every oak branch they cut, weighed every bundle that was taken out of the forest, and recorded the age and gender of every single person that I followed into the forest. With Burt's guidance, I set-up plots on slopes (that were often extremely steep) in a protected forest and in a heavily-lopped forest to compare regeneration and the nutrient content of the soil and

leaves. Since I had collected the exact same data in 1993, I could evaluate the change in the forests between 1993 and 2006.

When I was getting ready to fly to India to begin my field work, Burt knew that this would be the only chance I would have to collect data because I only had three years to complete my Ph.D. and had very little leeway for mistakes. Burt gave me his calling card number and instructed me to call him collect once a month to discuss the progress of my data collection. Even though he never got a chance to visit my field site, he always gave pertinent advice and guidance on mountain ecosystems and data collection methodology. What made Burt most incredible was that once you were his student, you were forever his student, even after you graduated. After I graduated in 2009 (Figure 2), I spent two weeks each summer until 2013 living in Burt and Dixie's attic in Ann Arbor to focus on drafting journal articles based upon my dissertation research. Due to the ceaseless support from Burt, the first article that I submitted to *Mountain Research and Development* was accepted within three weeks!

FIGURE 2. Yuka Makino celebrates her Ph.D. graduation with her parents and Burt Barnes, May 2009. Yuka was Burt's final PhD student. Photo by Yuka Makino.

(Ikuyo Saeki)

Burt's curiosity and passion for learning reached far beyond North America. His interest in the ecology of forests extended to the diverse ecosystems across Asia. Burt's experiences in Germany and China are well known, but lesser known is his decade-long research on the threatened Japanese red maple (*Acer pycnanthum*) in Japan. He began visiting Japan from 1997 and travelled from Hokkaido to Nagano, Gifu, and Aichi. He gave talks to Japanese conservation groups on the ecology of the Japanese red maple and wrote articles for their newsletters. As he did in China in the 1970s, Burt visited remote rural areas and immediately became the center of attention. When he visited Iida-city, Nagano, he stood beside the largest red maple in the city, which had been struck down earlier by a typhoon, and gave an interview to the local newspaper. His photograph appeared in many newspapers the next day. In 2004, he gave a presentation on Japanese and American red maples at a small public symposium in Japan. Drawing on his experiences in China decades before, he greeted everyone with "*Kon-nichi-wa*!" ("Hello!" in Japanese) and received a warm and loud applause from the audience. I helped interpret his talk into Japanese. Because of his friendly personality and hard work, he was deeply respected and loved by everyone he met.

I completed my M.S. at SNRE 1998, and, like most of his other students, I developed a lifelong friendship with Burt. I completed my Ph.D. in Japan while focusing on the ecology of Japanese red maple and its application to conservation in Japan, inspired by Burt's visits to Japan. Since my university did not formally permit a professor from another university to be on the dissertation committee, Burt informally acted as my advisor throughout my Ph.D. program and helped me with my fieldwork and writing until I graduated in 2006. Burt's approach differed from that of many Japanese ecologists, and he taught me to view nature beyond the individual parts of the systems, such as species, at the "ecosystem-level". He taught me two important lessons: that knowledge is power—an intensive literature review is the first step to doing good research, and that field work is essential to an ecologist. He emphasized that observing nature directly was the basis for new ideas.

* * * * *

Burt's vast interests and vision transcended borders, and, coupled with his personality and constant curiosity, he inspired research by people from any nationality and anywhere in the world. Burt's spirit continues to grow around the world within all the students he has nurtured. We are greatly honored to have been Burt's students and to have had the opportunity to be mentored and taught by him. We will forever be grateful for his guidance and his inspiration.

BURTON V. BARNES: AN EXTRAORDINARY TEACHER DEVOTED TO STUDENT LEARNING

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For thousands of his students at the University of Michigan and its Biological Station, Burton Barnes was a stand-out teacher—a teacher who helped us not only to learn about and appreciate woody plants and their ecosystems but to forge deep connections to their landscapes and to the processes on which all life depends. Although the two of us encountered Burt Barnes (to us, "BVB") at the opposite ends of his teaching career, our recollections of BVB the person and BVB the teacher were remarkably congruent. It is our great pleasure to share some of our happiest memories of BVB, who loved learning and loved creating learning occasions for us, his students.

Jean was a student in the first offering of the Woody Plants course (then called "Dendrology") fifty years ago, when BVB and Warren "Herb" Wagner, Jr. co-taught it for the first time in 1965. She took BVB's first offering of Forest Ecology (then called "Silviculture") the following fall. (The course names soon changed to reflect their actual content!) Although she went on to concentrate on interpretive natural history with Ross Tocher and then, as a graduate student, on environmental education with Bill Stapp, Jean became lifelong friends with BVB and his wife Dixie, occasionally babysat for their kids, and kept in frequent touch with them after leaving Michigan. Over the decades, they shared many memorable forays in the field in the coastal forests of Georgia and Washington and in Canada's Algonquin Park. She had the great privilege of reviewing the 1998 edition of *Forest Ecology* in its draft form and of joining BVB and his Forest Ecology class on his last Great Smoky Mountains field trip in 2003.

Melanie took Woody Plants from BVB and Herb in 1989 as a pre-med senior in the Biology Department at Michigan in need of one last science lab course. The course changed her life. After graduating from Michigan in the spring of 1990, she stayed on as the collector for Woody Plants, took Forest Ecology the following fall, and became a research assistant in BVB's lab. In 1993, she enrolled as a graduate student in the School of Natural Resources and Environment with BVB as her advisor and mentor and was a Graduate Student Instructor (GSI) and later the Laboratory Coordinator for Woody Plants from 1993 to 1995.

When BVB was on sabbatical in 1998, she co-taught Woody Plants with Herb and co-taught Woody Plants after Herb passed away in 2000 and until BVB retired in 2006. She co-taught Woody Plants for the final time with Chris Dick in 2007. She assisted BVB with the last edition of *Michigan Trees*, and is co-authoring *Michigan Shrubs & Vines* with BVB and Chris Dick, due out in 2016.

A Quintessentially Conscientious Teacher—with a Sense of Fun

BVB took his teaching—and his students' learning—seriously. Meticulous planning went into every lecture, lab, and field trip. BVB would carefully prepare for every lecture, going through every slide, right up to his last lecture at the end of his career. He had that rare ability to explain concepts, even complicated ones, with clarity and enthusiasm. From the first day of class in Woody Plants, for example, students sensed they were in for a treat because of the evident excitement they saw in BVB and Herb Wagner playing off each other; it continued unabated through the entire course. It is hard not to conclude that BVB and Herb both became much better teachers from their many years of collaboration, both in lecture settings and in the field.

From the very outset, BVB was a reflective practitioner who knew how dependent student learning was on good teaching. Jean recalls one instance when he wasn't sure he'd adequately explained a concept. "In Forest Ecology, I was usually a front-row student; BVB's lectures were so densely packed, I wanted no distractions! A few weeks into the course, BVB approached me in the hall and said, 'I have a favor to ask. I've noticed that you seem to take copious notes in class.' 'Yes, I guess so,' I probably answered, not sure where this conversation was headed. With some hesitation, BVB ventured, 'Would you allow me to read over your notes from yesterday's class? I'm not sure I adequately explained issues around . . . .' BVB went on, 'It's pretty important for what's coming next in the course. I figure if you didn't get it, I will need to review it to make sure everyone understands it.' Self-consciously, I handed over my notebook. Sure enough, I had apparently missed the point—or BVB hadn't fully explained it. In the subsequent class, BVB gave me back my notebook and started the class with, 'We need to go over something once more, I am pretty sure that I didn't explain it adequately last week.' I was astonished. No teacher I'd ever encountered was so open to admitting having made a mistake or so intent on making sure his explanation of a concept was completely clear to everyone."

BVB knew that laughter could lighten and *bolster* learning—as anyone who experienced the traditional "Halloween Howl," the first indoor identification exam of Woody Plants, can attest. This event was the capstone of the Woody Plants mid-semester exams. With the outdoor field exam and written exam on lecture material behind them, students then faced the "Howl"—50 stations of herbarium sheets, twigs, fruits, and fresh specimens. This exam typically occurred in the evening at the end of October and morphed through the years to the point where BVB encouraged students to dress up as their favorite plant, thereby bringing out incredible levels of creativity and turning an otherwise stressful exam into an event of lore. Students and TAs alike dressed up as witch hazel (*Hamamelis virginiana*), white ash (*Fraxinus americana*), American beech

(*Fagus grandifolia*), black locust (*Robinia pseudoacacia*), shagbark hickory (*Carya ovata*), prickly ash (*Zanthoxylum amaericana*), white oak (*Quercus alba*), and more. Students represented plants both literally—pieces of hanging bark with a squirrel fitting beneath (shagbark hickory)—and figuratively—a preacher with arms spread wide (prickly ash). One student even dressed up as "poop-on-a-stick," the Woody Plants name for a gall that grows on species of *Prunus* and that is often helpful in winter identification. All this was capped by BVB showing up in a bat outfit, complete with a long black wig and white face makeup, and by plenty of howling. Prior to the exam, the students nervously staged in a room outside of the exam area, the lights were turned off and then flickered, the howling began, and suddenly a black figure with wings (BVB!) appeared. Exam directions were given in a creepy, batty voice. BVB never once broke character at these exams, and could be found wandering around the exam room during the testing period, rearranging specimens with his bat wings or standing silently with wings and head tucked in a resting state and the occasional dramatic flap. This was one way BVB managed to create a learning atmosphere in Woody Plants that required a great deal of mastery and attention to detail, but made it collaborative, engaging, and loads of fun.

Getting to Know the Characters; Understanding the Play

BVB's approach to Woody Plants and Forest Ecology was a holistic, field-based, ecosystem approach. To understand forest ecosystems was to weave together site factors such as climate, physiography, and soil with the biology and ecology of vegetation and other organisms. In Woody Plants students learned the trees and shrubs of Michigan in the field where they naturally occurred, with hands-on experience. Although the focus in Woody Plants was on learning plants, BVB emphasized that plants did not stand on their own. BVB used to say "you can't understand the play if you don't first get to know the characters." Woody Plants was getting to know the characters—the trees, shrubs, and vines—and Forest Ecology was understanding the play—the ecology and interconnection of the parts.

During the early offerings of the Forest Ecology course, students were divided into teams at a field lab at Stinchfield Woods and asked to completely excavate a single root of a single tree *without breaking it.* Teams of four or five students were each assigned to a different type of mature tree, either coniferous or deciduous. This turned out to be a physically demanding, but hilarious, endeavor, the students taking turns keeping the root intact while others were digging. As ever more slender portions of the root were exposed, shouts of encouragement and shrieks of "Careful!!' accompanied the work of teasing each rootlet to its tiny end, less than 2 mm in diameter. Once the roots were fully exposed, the teams came together to visit each tree and its exposed root to compare root sizes, shapes, and directions of growth. BVB asked the students to visualize a lateral view of the entirety of the tree—roots and all—and then an aerial view. He was trying to get everybody thinking about competition as not being just for light with respect to crown coverage, but also as competition among the many root systems in the ground. He challenged the teams to discuss ways they would mea-

sure all the biomass of our given root system. Finally, after taking measurements, the students reburied the roots. This exercise built a brilliant and tangible scaffolding for BVB's subsequent lecture on root biomass, root function, and intertree competition.

From the beginning, BVB was eager to try out new approaches. One year, towards the end of the term, the Forest Ecology class assembled for an indoor lab with less enthusiasm than usual; perhaps the darkening autumn days and the unrelenting pace of the semester were sapping the students' energy. There were no directions for the lab, just random piles of nuts and bolts and screws of various sizes and shapes and colors along with some chalk on each of several tables. BVB called the students together with a mischievous smile. The goal of this lab, BVB explained, was to imagine two or more contiguous ecosystems with which "everyone in the class should be familiar by now." They could be natural systems or disturbed ones, apparently older systems or younger ones. After the students had been divided into working teams of four or five, one assigned to each table, the teams were each to decide how to create a simulation or map of these systems, choosing which nuts, bolts, or screws would represent their most representative species, chalking in some boundaries if needed. After the teams had created their simulated ecosystems, BVB asked them to move as teams from table to table to identify what each of the *other* teams had created and to make their as best guesses as to the major species being represented by the various bits of hardware. Students were engaged! There was intense quiet, then the buzz of ideas, and then, explosive laughter as riparian systems, overgrazed woodlots, hardwood forests with shelterwood cuts, and spruce bogs took shape (Figure 1). Students saw this as intriguing and fun, but the exercise was extremely powerful. It challenged students to conceptualize a landscape and its spatial characteristics, and then the species they would expect to find there. It was amazing that teams could

FIGURE 1. The Forest Ecology class participates in the "nuts and bolts" exercise, December 1967. Original photos by Jean MacGregor.

identify most of the other landscapes that were created. It drew on the students' knowledge as well as their imaginations. And creating puzzles for others to solve added to the magic.

Understanding the Territory

Throughout his career of teaching Forest Ecology and Silviculture, BVB stressed how important it is to pay attention to the entire ecosystem, seeing not only the trees, but the larger ecosystem as well. The seeds of this thinking were quite likely planted by BVB's mentors, Stephen Spurr and Gerhard Schlenker, a key colleague in Germany, and then further developed through his collaborations with Bob Zahner, Stan Rowe, and Don Zak.

In the 1960s, BVB would lecture on the German notion of the local ("örtlichen") and the iron law of the site ("Eherne Gesetz des Örtlichen"), stressing that deep knowledge of the total ecosystem was crucial to any management decision. As this ecosystem approach deepened and expanded over time, it infused BVB's teaching and significantly framed his research and writing (Barnes 1996). As the years progressed, BVB found creative ways to convey this message in his courses. In the second lecture of the Forest Ecology course beginning in the 1980s, much to everyone's surprise, BVB sang the entire song 'Rock Island' from the opening scene of *The Music Man*. 'Rock Island' takes place on a train with a group of traveling salesmen and is sung to the rhythm of the train movement. It is a complex song in rhythm and meter and in the number of characters partaking in the lyrics, and BVB played them all while accelerating and then slowing down to a stop in making the point 'You've gotta know the territory.' Students had seen BVB perform in Woody Plants before: recreating the drama of the 'world largest organism,' putting on a Mao suit while giving a lecture on the plants of China and Japan, and dressing up as Batty Burt for the Halloween Howl, but this was a new level of boldness. This theme, 'you've gotta know the territory,' was central in Forest Ecology, and BVB's catchy but significant way of getting students to think holistically in understanding the concept of a landscape ecosystem hammered the concept home.

A big component of BVB's approach to teaching involved "können und wissen" from the German for "doing and knowing." The crowning achievement of the field component in Forest Ecology was known as the 'Ecosystems of Mystery,' where students were shown a new and unfamiliar place in the field and asked to assess the landform; explain the horizons in soil pit; identify plants in the overstory, the understory, and the groundcover; and finally put it all together in explaining the local ecosystem and 'what's happening?' The Ecosystems of Mystery component took place towards the end of the semester as an opportunity to pull all field skills together in an individual (and later a group) exercise. Students had a lot of nervous anticipation with respect to the Ecosystems of Mystery: Where would they take us? What would they ask us? Would there be any tricks? Up to this point in the semester, students had spent extensive time in the regional landscape ecosystems of southeastern Michigan and had taken long weekend field trips to the Biological Station in northern Michigan and to the Great Smoky Mountains (Figure 2). The "doing and knowing" approach was best

FIGURE 2. Burt Barnes, in coonskin hat, warns Forest Ecology students of their time constraints before allowing them to explore on their own at Clingman's Dome, Great Smoky Mountains National Park, October 1992. Photo by Dan Kashian.

demonstrated in the Ecosystems of Mystery—an opportunity for students to demonstrate what they knew while learning in a novel environment. In addition to the actual Ecosystems of Mystery, there was a *practice* Ecosystem of Mystery at Stinchfield Woods, which nobody knew was coming except BVB and his GSIs. Coming down the road, students stumbled upon a large flagged off area with a soil pit. Former students will undoubtedly remember the anxiety—will I know all the plants? Will I be able to determine the soil textures? Was this ice contact or moraine? Invariably, however, as students moved through the exercise, taking in the physiography, inventorying the overstory, understory, and groundcover, and then assessing the soil pit (Figure 3), it all started to make sense! This is the core of how BVB taught—how to see and understand the natural world, and at the same time, marveling in the mystery.

Making Connections

Jean recalls: "In recent years, BVB and I would enjoy 'catching up' phone calls, particularly when one of us was eager to recount a recent forest adventure. Sometimes this was simply storytelling. Other times, BVB made it another lesson in connecting the ecological dots. In 2005, just before he retired, we had a memorable conversation about thatching ant nests (*Formica rufa*) in the forests around Lake Baikal in Siberia, where my husband Rob and I have been supporting the Great Baikal Trail, a Russian non-profit that marshals volunteers from

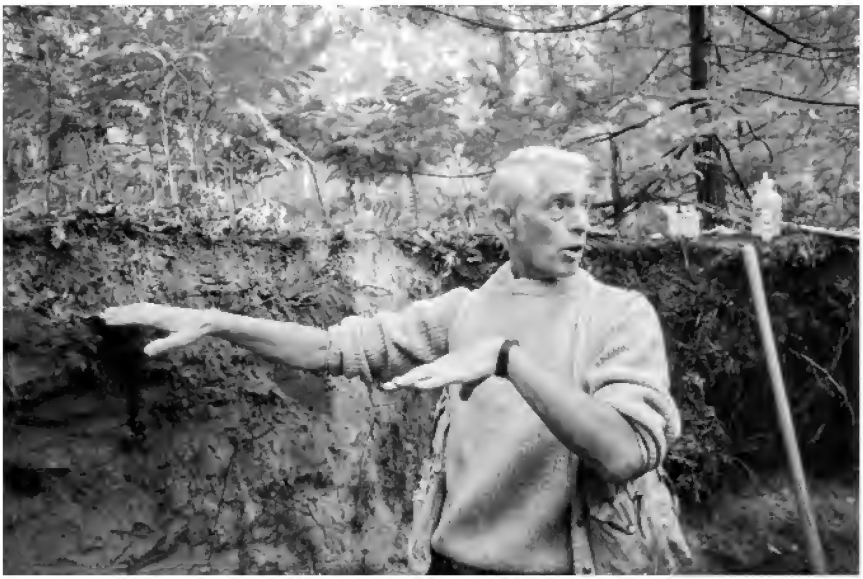

FIGURE 3. Burt Barnes teaches in a soil pit as part of his holistic focus on forest ecosystems, September 1983. Photo courtesy of the Burton V. Barnes estate.

throughout the world to create and maintain trails in the parks and protected areas around Russia's magnificent—and still remarkably unspoiled—freshwater lake. I was telling BVB about the huge thatching ant (a.k.a. wood ant) nests—as much as two meters wide and high—that are ever-present in the forests along the lake and on the islands as well. Our Russian colleagues also pointed out that a highly disturbed or broken-apart thatching ant nest is a sure sign of the presence of brown bears. In the brief summer months, the ants move their eggs and larvae higher in the nest toward greater warmth; although it is perhaps beneficial to the ants, this location carries a risk: eggs and larvae are now more vulnerable to marauding bears. But the thatching-ant-nest puzzle on which I wanted BVB's take was the dramatic disparity between the sizes of these nests on the mainland and on the islands. The island nests were at least half-again as large as those on the mainland. Ever the teacher, BVB asked, 'What did you observe?' 'Well, along the lakeshore, the conifers (i.e., the source of the plant material for the "thatch") are pines (*Pinus sylvestris* and *Pinus sibirica*) and Siberian larches (*Larix sibirica)*, but on the islands, the forest is entirely a larch overstory. But needles are needles; I wouldn't think any one kind of conifer needle would necessarily lead to a larger colony. Maybe there would be more sunlight penetration because larches are deciduous; maybe the ant colonies have a longer growing-season?' 'Very possible. What else?' probed BVB. 'Maybe bears would be more numerous on the mainland and therefore they'd destroy more nests. Though I'm not sure about this since bears have easy access to the islands, particularly when it ices up for at least four months each winter.' 'What else?' BVB persisted. I was

beginning to run out of ideas. 'The bigger nests are on the *islands,* right?' BVB hinted. 'Oh, of course!' I said, 'Fire. Or the lack thereof. On the islands.' 'Yup.' he said. 'Pretty remarkable,' I smiled. 'Tooooo much!' he agreed. I loved conversations like this."

Teaching and Mentoring

When BVB taught his Advanced Forest Ecology course for the last time in 2003, the students in the class came together to present some end-of-the-course gifts to BVB. Among them were *The Giving Tree* by Shel Silverstein and a hand-drawn diagram that portrayed a *Populus tremuloides* clone with BVB as the genet and all the students as ramets. In response, BVB wrote a note to the class. We think it fitting to end with his words, not ours, and to be reminded once again of his immense love of his field, of us, his innumerable—and deeply grateful—students. Here is what he wrote:

> The I-love-BVB-clone is "tooooo much" because it not only links all of us together to the Earth, but points to an even more wonderful idea. We are each ramets of individuals who have touched and changed our professional and personal lives. I'm a ramet of people like Steve Spurr, Herb Wagner, Stan Rowe, Gerhard Schlenker, Bob Zahner, each of whom gave me inspiration, insights, and know-how. Certainly too, one is a genetic ramet of our parents and ancestors. And over the years, I have been sustained and encouraged by many students whose talents and energy were amazing. More important is that we, as ramets, have passed on to each new generation the best of their ideas and lives.
>
> *Burton V. Barnes,* 2003

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UNDERGRADUATE MEMORIES OF BURT BARNES

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Woody Plants was my gateway drug. As one of the 6,000 students lucky enough to have Burt Barnes as a professor, the ambiguous green blur of the plant kingdom came sharply into focus and became a source of endless joy and curiosity.

Woody Plants was so well-loved because four decades of curriculum development led to the perfect union of fun and challenge (Figure 1). I can think of little as daunting as that pile of 500 twigs stripped of leaves on the lab bench, and knowing that I had to memorize them all. But with the proper attention, the character of each species emerges: the taco-shaped bud of *Alnus* spp., the lopsided ice cream cone of *Tilia americana*, the hitchhiker's thumb of *Ulmus americana*, the devil's head in *Robinia pseudoacacia,* and the evangelical preacher reaching

FIGURE 1. Burt Barnes works with undergraduates on twig identification at the University of Michigan Botanical Gardens in the early days of Woody Plants, November 1967. Photo by Bruce Dancik.

FIGURE 2. "Batty Burt" prepares students for the "Halloween Howl", the midterm identification exam in Woody Plants, October 2005. Photo by Melanie Gunn.

out from the *Xanthoxylum americanum* twig. It was possible after all! Learning the plants and diagnostic characters in the field and having the opportunity to study the specimens, fresh and neatly curated, 24 hours a day, was all we needed.

Burt had a theatrical flair, and he loved to incorporate props and costumes into his lectures. To demonstrate the nature of serotinous cones, he took a blow-torch to a scraggly limb of jack pine and set it ablaze at the front of the lecture hall so we could watch the closed cones open before our eyes. A sheet was laid below to collect all the seeds, which were then germinated and parceled out among the students as a parting gift on the last day of class.

The most memorable testament to his creative genius was the so-called Halloween Howl. It so happened that our mid-term exam fell on a full moon on the night before Devil's Night. He invited all students to arrive in costume. We filtered in, nervously giggling at the boy struggling to keep the black ash bark from sliding off his backside and glancing apprehensively at the hole in the mystery box we would have to reach into to identify by touch what we hoped would be a plant specimen. At the front of the room, standing completely motionless, was a decidedly Nosferatuesque figure, robed in black and pale as the moon, with long silver hair (Figure 2). After several awkward minutes had passed we heard a blood-curdling scream, and the lights in our windowless lecture hall went out. The screaming continued, now as dozens of voices, as the heretofore motionless figure extended its massive black bat wings and began to flap furiously about the room, creating a stiff wind as the Graduate Student Instructors flickered the lights like lightning. Once the chaos subsided, Burt welcomed us to the exam,

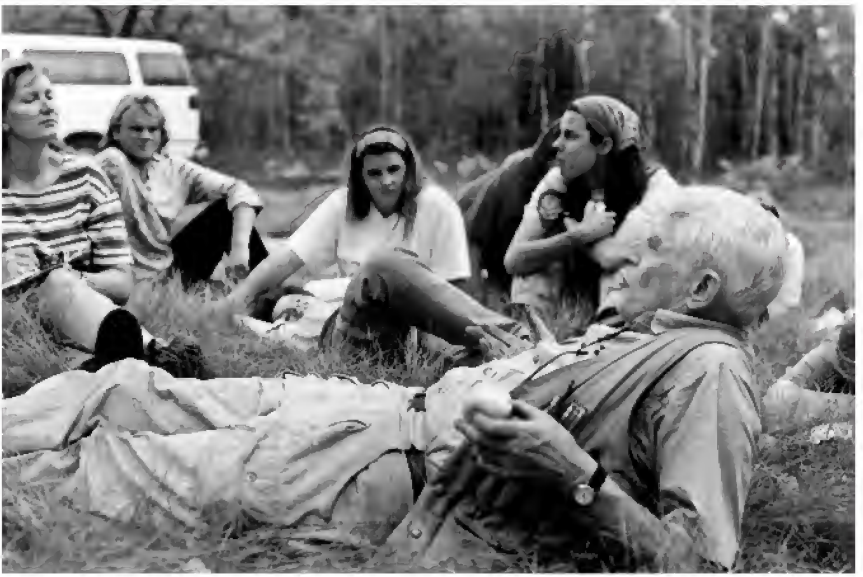

FIGURE 3. Burt Barnes and students in the Forest Ecology class talk and relax at the Pellston Plain, University of Michigan Biological Station, September 1995. Photo by Dan Kashian.

and we began circulating through the denuded twigs, scraps of bark, fresh leaves, and herbarium sheets. Although the mystery box with a hole and a sleeve was creepy and intimidating, there was nothing inside but an Osage-orange.

Although Burt's classroom lectures were unrivaled in their liveliness, his ideas were best grasped in the field, where he was completely at home (Figure 3). In a Forest Ecology mini course at the University of Michigan Biological Station (Figure 4), he led us to a cedar swamp where he engaged with his surroundings. While discussing the development of soil horizons, he plunged his arm into the mucky matrix up past his shoulder and withdrew a black glistening lump of it, which he unhesitatingly shoved it into his mouth to feel for grains of sand to determine whether it was a purely organic soil or had a mineral component. He continued to lecture, flecks of peat launching from his lips as he contrasted the glacial history and soil development of the cedar swamp with those of the neighboring sugar maple-covered moraine with its sandy soil horizons.

Burt always had time for his students, and he took pride in helping them along whatever path they chose. In his last year of teaching, he wrote 109 letters of recommendation. He took meticulous care to portray a student's specific qualifications accurately by studying the details of his or her CV before writing a letter. His generosity, his sense of humor, and his infectious enthusiasm for the natural world will be remembered. His legacy continues as the thousands he inspired

FIGURE 4. Burt Barnes teaches soil during a Forest Ecology mini-course at the University of Michigan Biological Station, June 2005. Photo courtesy of Jennifer Muladore via University of Michigan School of Natural Resources and Environment Flickr page under a Creative Commons Attribution 2.0 Generic license; desaturated from original; original at www.flickr.com/photos/snre/14425662238/.

build upon his research, make environmental policy decisions, or enjoy quiet walks in the woods.

ACKNOWLEDGMENT

I wish to thank Dr. Thomas J. Rosatti, of the University and Jepson Herbaria, University of California, Berkeley, for reviewing the first draft of this article.

"SNAPPY ANSWERS ANY TIME I'M IN": BURT THE MENTOR

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Like countless other students who crossed paths with Burt Barnes, I was lucky enough to have a mentor who steered the ship of my career more or less from the day I met him face to face. This was the case with almost every student with whom he crossed paths. Burt mentored every single author in this issue and others all across the country in one form or another, many of whom could do a better job than I of describing the experience of being a "Burt mentee." This was what made Burt different, special, and beloved. Whether it was an undergraduate student in a Woody Plants class of 150 students or a fourth-year M.S. student, Burt had a way of making every student feel as though he or she was being given individual attention from day one. For over 40 years he welcomed everyone with a small sign on his office door—it yellowed through the years—that read "Snappy answers any time I'm in." It was no secret—it was the way he worked—and my experience is but one example.

Burt mentored at all academic levels (Figure 1). He was rigorous but understanding in his teaching approach, and he demanded that both graduate and undergraduate students perform well in his courses. He was quick to counsel undergraduates who showed any level of interest in forest ecology, whether or not they showed promise. His exams—"performances," he called them—always included long essay-type questions that a couple of undergraduate students typically missed completely on any given exam. In such cases, Burt was known to call the student quietly into his office a day or two after the exam, explain that he or she had completely missed the point of the question, and hand the test back to them to try again. He explained that he was more interested in encouraging students than in failing them, and that their grade in the course would work itself out in the end. "We're not here to pull weeds," he would say, "we want to plant seeds."

Few undergraduates saw Burt "behind the scenes," however, and that is what it took to understand fully the levels of his ability to mentor and to teach. Most of Burt's graduate students witnessed his extensive and detailed ecological and botanical knowledge and his attention to detail in the way he taught his courses. In the demonstration and exam materials for Woody Plants, no twig could be unclear, no leaf atypical; in his Forest Ecology course, every soil pit had to be pristine, every plot line perfectly straight. Burt prepared his field courses like a madman, but at the same time it was clear that his expertise was boundless and not "prepped for." Name a species, and Burt could tell you its shade tolerance, nutri-

FIGURE 1. Burt Barnes teaching students in the field at the University of Michigan Biological Station, June 2005. Photo from University of Michigan School of Natural Resources and Environment Flickr page under a Creative Commons Attribution 2.0 Generic license; desaturated from original; original at www.flickr.com/photos/snre/14420734587/.

ent requirements, fruit type, and dispersers; the soil type it prefers; its tolerance for temperature variation; its tendency to hybridize; and its competitive ability, all off the top of his head. We used to snicker in the back of the class as Graduate Student Instructors (GSIs), because we were certain he had to be making it all up. But we were wrong. Looking back, I am still amazed at his ability to interpret the landscape, to predict and then to find plants where nobody else could. But this was part of his approach—the idea that you needed to know your surroundings extremely well in order to learn something further about them. Perhaps Burt's most well-known advice to students was "Ya Gotta Know the Territory," and it was much more than just an entertaining bit he performed in front of the class. For a student, it was a daunting, exhausting, and somewhat impossible charge—but certainly effective.

A bedrock principle of Burt's philosophy was hard work. Burt was born and raised in the Midwest, and he certainly had that stereotypical Midwestern work ethic. He was not a believer in idle hands; he expected hard, steady work. While I was digging soil pits with him in dry jack pine forests in August heat, he once told me, "If you're gonna die, die with your boots on." As his students, we all had to follow this same mantra, and in most cases we did so willingly, because this is how we thought it was supposed to be. He did not permit free time during field labs or field research, either for himself or for his students, except perhaps what

might be carved out of a break for lunch or dinner. "Free time?" he once sarcastically answered an undergraduate, "What's that?"

Another important principle in Burt's work ethic was that as a student you needed to "pay your dues." At least in the latter half of his career, he strongly believed that you needed to come up slowly through the ranks. He often identified the best undergraduates in the Forest Ecology course and recruited them to be field assistants for his graduate students. Very often those field assistants would then turn into his Master's degree students; if they were joining an established project, they would tag along with the more experienced graduate student in the field for the first year before being allowed to embark upon his or her own research the following summer. Such an approach often made for very slow progress, but it also ensured success, as well as field hardiness. It also made for an enormous list of completed M.S. degrees under Burt's tutelage.

Though he demanded that his students work as hard as he did, Burt also understood that pushing his students hard required a sensitive touch. This type of mentoring often seemed to come out of the blue, when we needed it the most. One particular weekend, I was working alone in the field, trying to accomplish everything I thought I needed to for the summer. I was miserable. I remember distinctly getting home that Saturday night, frustrated and exasperated, and calling Burt at 8 pm. The specifics of the phone conversation that night have faded, but after two hours (Burt's bedtime was always 10 pm), I hung up the phone feeling everything was all right. In the toughest of times Burt was always grateful for hard work, always encouraging, and always made me enjoy what I was doing.

Burt's work was his life, and he never strayed far from it. My wife and I invited Burt and Dixie to our wedding in the early 1990s. Burt disliked attending weddings—he told me as much—but he attended ours because it was near campus. He wore a light blue suit and bow tie, and so he stood out well in most of the resulting photos taken in the church and at the reception. In looking at the photos later we noticed that Burt had been constantly reading a German paper called *Das Pflanzenleben der Schwäbischen Alb* (Plant life of the Swabian Alb). Apparently he was having trouble translating as he read, because the photographic evidence indicated that he must have been reading it from the time he entered the church to the time the cake was cut. Also caught on video was Burt graciously introducing himself to my parents—as the groom, I either had been too busy or had never guessed he'd be interested in meeting them—and my father's remark about how much I had talked about Burt. When I later explained to Burt that my parents had since spoken very highly of him, he remarked "Well then, I'm very glad I made a good impression!"

Burt's frugality was legendary, but it was part of his character to take care of his students within the bounds of his thriftiness. He often bought copies of books for his GSIs, or gave copies to them, at the end of successful fall teaching terms, or he brought home trinkets from his travels out West or overseas. When he visited his graduate students and their crews in the field (Figure 2), Burt was sure to splurge and take the entire field crew (often two graduate students and one or more undergraduate field assistants) out for dinner. I remember my own field work near Mio in northern Michigan with Burt and another graduate student between 1995 and 1997. Burt had a wheat allergy that prevented him from partak-

FIGURE 2. Burt Barnes (center) clowns around in a cowbird trap with graduate students Glenn Palmgren (left) and Wayne Walker (right) near Mio, Michigan, July 1996. Photo by Dan Kashian.

ing of the fried cuisine of the local restaurants in the smaller northern Michigan towns, so he always wanted to go somewhere that had a salad bar. At the time, that meant Wendy's. So the three of us would drive the 45 minutes or so to the nearest Wendy's in Grayling, where Burt would treat us to dinner. Back in the 1990s, Wendy's would give you a breadstick when you ordered the salad bar; of course Burt couldn't eat it, so he would give it to one of us. During the two and a half field seasons of our work, Burt carefully kept track of whose turn it was to get the Wendy's breadstick for each of our 10 to 12 or more visits to that establishment.

Although the consummate mentor, Burt also often gave subtle reminders that he would not be outdone by his graduate students. I first recognized this as his GSI in Forest Ecology on one of the weekend class trips to the Great Smoky Mountains, which he used to lead each year in late October. We used to hike to a large waterfall called Ramsey Cascades, but on that particular trip the weather was unusually dreary, the temperature was only about 40°, and the water was very cold. Burt had a custom of walking in the water to the base of the falls in front of the class, but that year, because of the cold, he stopped short of getting himself wet. Then, since the other GSI and I had dressed too warmly, we stuck our heads under the freezing water to cool off. "You guys really went in that water?" asked Burt. He smiled, quickly disrobed down to his underwear, and

took an extended bath in the icy water to the deafening applause of students, other visitors, and park rangers. Somebody snapped a picture, and it remains on my office wall to this day.

Burt's establishment of a "pecking order" was not just for show; many of his skills, in addition to his academic brilliance, left his graduate student shaking their heads in disbelief. When he was an undergraduate, Burt's summer job with the US Forest Service required him to climb to the tops of ponderosa pine (*Pinus ponderosa*) and western white pine (*P. monticola*) trees to collect pollen from the male cones and entire female cones for their seeds. After climbing the trees, Burt and his co-workers would leap among the treetops like wood sprites in order to save the time that would be needed to climb back down one tree and up the next. This skill never left Burt; he used to teach conifer reproductive biology at Stinchfield Woods, where the GSIs were required to scale the white pines (*P. strobus*) during the prep trips for the field lab to collect cones from the tops of the trees. Most of us did this gingerly and often too slowly and carefully for Burt's taste, but he always let us try first. Each year that I taught the course with Burt, the GSIs were given their chance to climb, but then were asked to get out of the way so that Burt could fly up the trees—he was 65 or so at the time—and then smoothly move from treetop to treetop. Even as we gained confidence as Burt's graduate students, it was clear that sometimes we just needed to step out of the way.

Burt did not appreciate cockiness, and an important part of his mentoring was instilling the importance of humility in his students. Burt led by example in this regard; for example, as much as he talked to students about "The World's Largest Organism"—a giant aspen clone he discovered in Utah in the late 1960s—he purposely avoided the media attention that it and its investigators attracted in the 1990s. He had an unspoken expectation of the same from his students. He was not an overly "atta-boy" or "atta-girl" mentor, but small doses of praise from him were golden. Although he was effusive with praise for his undergraduates, with famous lines like "Mighty fine!" or more often "Toooo much!" written on successful exams, his graduate students would more often hear of his approval only indirectly from associates or other colleagues. On rare occasions, however, he would open up about his satisfaction regarding a student's performance. I remember my last day in Ann Arbor before leaving the state to pursue a Ph.D.: I was loading my office materials into my car, and Burt was helping (of course!). As we said our goodbyes, he turned and, in a brief moment of sentimentality, said quickly, "Well Dan, what you've done here might be the best work you'll ever do." It was Burt-speak, I assumed, for "good job."

Burt impressed upon his students—without selfish motives—how much he appreciated his own mentors. He talked at length about Steve Spurr, Herb Wagner, and Stan Rowe to his students, to the point that we felt as if they, too, were our mentors. But he never relied on them too strongly, and he made a point of being his own person. Burt advised his own students to do the same. Even as we remembered Burt as our mentor, we knew that he would surely downplay his own influence. In speaking of his relationships with his mentors and, in turn, of his own relationship as a mentor with his students, Burt used to like to use the analogy of an aspen clone (who would have guessed?): the new ramets arise from

FIGURE 3. Burt Barnes discusses an aspen ramet with the Forest Ecology class at the University of Michigan Biological Station, September 2003. Photo from University of Michigan School of Natural Resources and Environment Flickr page under a Creative Commons Attribution 2.0 Generic license; desaturated from original; original at www.flickr.com/photos/snre/14420525698/.

the roots of the genet, and are nourished, supported, and sustained by the root system of the genet for a period of time, but eventually the connection between the new and the old disintegrates, and the ramets become independent (Figure 3).

As he did with many of his other students, Burt remained in close contact with me throughout my graduate school and postdoctoral years after I left the state. Postcards between us were common, as were long emails detailing anything of interest. He would often call long-distance and talk for two hours about whatever was on his mind. And—as with a parent—it was the time away from Burt that really instilled an appreciation for him and that made you realize that he was right about so many things. I remember that when I finished my Master's degree at Michigan, I was skeptical of Burt's approach to ecosystems—the idea that site factors of climate, landforms, and soil were just as important to forest ecosystems as the trees and shrubs—having toiled with it for so many years. Five years later, as a postdoc in Colorado, I began a study attempting to explain why some aspen clones were dying while others seemed to be thriving. One day at the end of the field season, it became clear that "site" was the strongest explanatory factor and that ignoring site factors was what had made it all so confusing to me and to so many others before me. For Burt, this may have been obvious all along, but for me, it was my re-christening, so to speak, and I rushed home to call Burt to tell him about it. He laughed that familiar Burt chuckle—"Ha ha, ho ho ho"—and said knowingly, "Well, Dan, I think you've finally got it."

Burt was very pleased when I was able to return to the state in 2006 for a faculty job, and we were able to take occasional trips together in the field. Most of those trips were his idea, to show me various teaching sites in the region or to do some field sampling. He was eager to share many of his secrets of teaching and research. We visited all of his favorite spots—Radrick Forest, Haven Hill, Hudson Mills, and several locations at or near the University of Michigan Biological Station, including the Pellston Plain, Poor and Good Aspen, an old-growth red pine ecosystem, and Colonial Point. It was during these trips that Burt began to open up about his life and his thoughts about things other than forest ecology or landscape ecosystems. I noticed immediately that he had begun to spend a lot of time just enjoying being outside, work or no work; often we sampled plots in the field just to spend time in the woods. Once in particular at the Biological Station, someone had jokingly told him that if you pressed your ear against the trunk of an aspen tree, the wind in the leaves would sound like bells ringing. We therefore spent 45 minutes in the field one day—what would have been precious time lost in the old days—trying to hear those bells (Figure 4). I found myself relating to him more than ever. I once complained to him about the administrators at my university, knowing that he'd be sympathetic since he was never particularly fond of administration, to which he responded with a laugh, "Congratulations! Now you know what it's like to be a faculty member." To my surprise, he added, "How's that for a snappy answer?" It was during these visits that Burt's mentoring cycle for me was completed—I had reached colleague status, and we were working together.

* * * * *

FIGURE 4. Burt Barnes listens for "the sound of bells" along the trunk of a young aspen tree as the wind blows its leaves, University of Michigan Biological Station, August 2013. Photo by Dan Kashian.

Burt sent me a short email on June 15, 2012, that said simply "I'd appreciate it if you would give me a call this weekend some time." Short messages from Burt were not common, and this had some sense of urgency that was not typical since his retirement. Something was wrong.

I called immediately, and found out Burt had cancer. My mind was a blur because of the news, and because Burt was asking that I take over an enormous list of things that he now felt he'd never complete. It was heartbreaking. When he came up for breath, I could only muster a few questions about his condition and prognosis.

"They say those that survive the surgery live 1 to 2 years 25% of the time," he explained. In my stupor, I asked what happened the other 75% of the time. "Well Dan, it's not good," he said, half laughing and half crying.

True to form, and to the way he lived his life, Burt was part of that 25%, and with ease. We spent lots of time together during the two years he spent in remission, including a week of sampling at the Biological Station. We also completed sampling for two manuscripts ("Just for fun," he said), and he made a great deal of progress towards the completion of *Michigan Shrubs & Vines*. As his condition worsened during the summer of 2014, he began to ask for help in the disposition of his materials. When I saw him last, he had asked me to transport him to

the UM Herbarium as he finalized some materials for *Michigan Shrubs & Vines*. It was difficult for him to walk and especially to speak, and he clearly was not feeling well physically or mentally. In my final image of him, he is walking back into his house when I dropped him off, shrub drawings under one arm, cane in the other, field vest on (why he wore a field vest to the Herbarium I'll never know). He stopped to wave goodbye, a gesture not typical of Burt, who in earlier days had always been in a rush to get to his next task. I believe he knew what I was denying at the time. He lost his ability to talk within a couple of weeks, but still kept sending messages via email, I presume until he could no longer sit up to type. One of my last emails from him said "I can't talk much any more—although I'd like to talk with you!"

Many folks are familiar with the feeling of the death of a mentor as leaving a major hole in their lives, and in their chests. I often catch myself seeing something exciting in the field or having something funny happen in class and thinking about calling or writing Burt to talk about it. I still have both his office and home phone numbers in my cell phone, where they always were, feeling like someday I might need them again. The final month of emails from him remain, as do his postcards on the walls of my office. He shaped a large part of my life and career, and he was my mentor and my friend. I miss him dearly.

So often we hear and read about what it means to be a mentor. Mentors teach, they inspire, and they shape lives with their advice and availability. They listen, sometime they collaborate, but always they nudge you down the correct path. Burt did all of these things as a mentor, but he also did so much more. His biggest and most successful accomplishment, which I surely hope he understood before he passed away, was the way he single-handedly changed the way so many people look at the world. In the last years of his life Burt felt that he had left too little a mark, too little of a legacy, behind him, despite his best efforts. But his legacy is enormous as measured by the work and livelihoods of every person he touched. Generations of former students are his legacy, and he has passed on a love of plants and ecosystems, of teaching, and of mentoring, to us all. His influence thereby continues to propagate through the lifetimes of others. After all, how many of us have never thought to ourselves "I need to do it the way Burt did it"?

BOOK REVIEW

Burton V. Barnes, Christopher Dick, and Melanie Gunn. 2015[2016]. *Michigan Shrubs & Vines: A Guide to Species of the Great Lakes Region*. 400+ pp. University of Michigan Press, Ann Arbor. ISBN ISBN 978-0-472-11777-2. Hardback. $65.00. ISBN 978-0-472-03625-7. Paperback. $26.96. ISBN 978-0-472-12107-6. e-book. Price TBD.*

Among the many signal accomplishments of Burt Barnes' career was the writing of *Michigan Trees*, co-authored with Warren H. "Herb" Wagner and published in 1981, followed by a revised and updated edition in 2004, long recognized as the finest guide to the trees of the Great Lakes region and beyond, and among the finest anywhere. The Preface to the revised and updated edition states that "[s]hrubs and vines will be considered in a companion volume to follow." This is that companion volume, and the 12-year wait has been worth it. In place of the late Herb Wagner, Burt has collaborated in this volume with two well-chosen co-authors, Christopher Dick, the current Director of the University of Michigan Herbarium and an Associate Professor who has also taken over Burt's woody plants class, and Melanie Gunn, a former Master's degree student of Burt's who is now the outreach coordinator for the National Park Service at Point Reyes National Seashore.

Michigan Shrubs & Vines follows the same format as *Michigan Trees*, except that the species in the former are arranged throughout alphabetically by genus. The species that are accorded full treatment are each given two full pages. One page has detailed descriptions collected under the topics (a separate paragraph for each) size and form, bark, leaves, stems-twigs, winter buds, flowers, and fruit, followed by sections for distribution, site-habitat, notes, chromosome number, and similar species, along with a dot map showing the distribution of the species in Michigan by counties (the map is an added feature—it does not appear in *Michigan Trees*). The facing page contains beautiful and detailed line drawings of the species illustrating separately such critical features (not always the same for each species) as leaves, leaf bases, winter buds, flowers, inflorescences, fruits, and seeds, each with labels. Below the drawings are several bulleted key characters and often one or two short paragraphs describing how the species is distinguished from a similar species.

The book provides several avenues for identifying an unknown shrub or woody vine. First, one may simply scan the book looking at the illustrations to find a match or near match. The choice can be confirmed by reading the list of key characters below, then, if necessary, delving into the more detailed descriptions on the facing page. The discussion of "Similar Species" in each species treatment is an important tool. It may provide distinguishing characters not only

* This title has not yet been released. The publisher has kindly provided me with an uncorrected proof copy for purposes of writing this review.

for other species of the same genus that occur in Michigan, some of which are accorded full treatments of their own, but for others that are mentioned in this book only in these notes, as well as related species that are not known to occur in Michigan.

Then there are the dichotomous identification keys. Five general keys start the process—one for coniferous shrubs, one for broad-leaved evergreens, and three for broad-leaved deciduous species, including one for plants with opposite or whorled leaves, one for plants with alternate simple leaves, and one for plants with alternate compound leaves. These keys lead either directly to a species treatment or to separate keys for certain genera for which three or more species are accorded full treatment (three genera with three or four species do not have separate keys—*Lonicera*, *Parthenocissus*, and *Spiraea*). The separate generic keys appear just before the alphabetical position of that genus, usually accompanied by lengthy discussions of the genus. Only the 138 species that are accorded full treatment are included in any of the keys. The key to *Salix* emphasizes plant form and leaves during the growing season and refers to Voss and Reznicek's *Field Manual of Michigan Flora* for keys to reproductive material. The five general keys are followed by two so-called "Quick Keys," or shortcuts, for species with readily observed features, namely one for plants armed with thorns, spines, or prickles, and one for woody vines.

This book is much more than just an identification guide. To those who already know the identity of a particular shrub or vine, the species discussion provides valuable details of its structure, habitat, range, and various other bits of information in the Notes section. The final 25 pages of the book include an in-depth discussion of the ecology of shrubs and vines, including such germane topics as historical biogeography (especially important in the glacial terrain of the Great Lakes region); sexual and asexual reproduction and the cycling between the two modes; native, introduced and invasive species; site factors (which, among other things, are critical for the establishment of a seedling), including light and shading, soil, the availability of nutrients, water and temperature; disturbance factors, or the lack thereof, and the geographic and ecological distribution. In regard to the latter, there is an explanation of the landscape ecosystems in Michigan in relation to shrub and vine species. This is a concept extensively developed by Burt Barnes during his career at the University of Michigan (see Albert et al., *this issue* pp. 34–41). Appendix A describes each of the four landscape ecosystems in Michigan—Southern Lower Michigan, Northern Lower Michigan, Eastern Upper Michigan, and Western Michigan—and provides maps showing their extent. In addition, the distribution notes under each species in the main part of the book gives the percentage occurrence by county of that species in each of the four regions; that is, 100% for a region means that the species is known from every county in that region.

Michigan now has a first-rate guide to all aspects of its native and introduced shrubs and woody vines that will serve as a first choice far beyond the borders of the state. The lifelong experience of its principal author shines throughout this magnificent volume.

——Michael Huft

INSTRUCTIONS TO AUTHORS

Refer to http://quod.lib.umich.edu/m/mbot/submit for more detailed instructions, especially for formatting, style conventions, literature cited, and voucher specimen requirements. Please contact the editor with any questions.

1. Create text in 12-point Times New Roman font and double space paragraphs throughout. Research articles should be organized as follows: Title, Author(s) and address(es), Abstract with up to 5 keywords, Introduction, Materials and Methods, Results, Discussion, Acknowledgements, Literature Cited, Tables, Figure Legends, and Figures. Sections may be omitted if not relevant. All pages should be numbered.

2. For noteworthy collections, manuscripts should be formatted as follows. The title, "Noteworthy Collections," should begin each submitted manuscript, followed on the next line by the State or Province for the species reported. The next line should list the taxon of interest using the following format: Species Author(s) (Family). Common name. The rest of the manuscript should include the following named sections: (i) Significance of the Report, (ii) Previous Knowledge, (iii) Discussion, (iv) Diagnostic Characters (if desired), (v) Specimen Citations, (vi) Acknowledgements (if desired), and (vii) Literature Cited. Each of these sections is largely self-explanatory; however, the "Significance of the Report" section should be limited to a brief sentence or phrase indicating the significance of the collection(s), and this may be expanded upon in the "Discussion" section; the "Specimen Citations" section should include the relevant label data from the voucher specimen(s) including location data, collector(s), collection number, etc., as well as the Index Herbariorum acronym(s) of the herbarium or herbaria where the specimen(s) are deposited. The manuscript should end with the name and address of the author(s).

3. Non-research articles, such as book reviews, letters to the editor, notices, biographies and other general interest articles can be formatted as general text without the specific sections listed above. However, literature cited and any tables or figures should be formatted as described below.

4. Create tables either as an MS Word table or using a tab-delimited format. Each table is to be submitted as a separate file. Table captions should be placed at the top of the table. Any footnotes should appear at the bottom of the table. Please do not insert tables within the body of the text.

5. Send each figure as a separate file in a high-resolution format—eps, jpg, or tif. Figures like bar graphs that gain their meaning with color won't work—use coarse-grained cross-hatching, etc. Create figure legends as a separate text file, and the typesetter will insert them as appropriate. Please do not insert the figure in the body of the text file.

6. Citations: Please verify that all references cited in the text are present in the literature cited section and vice versa. Citations within the text should list the author's last name and publication year (e. g. Smith 1990). For works with more than 2 authors, use "et al.", and separate multiple citations with a semicolon.

7. Literature Cited: List citations alphabetically by author's last name. The first author's name is to be listed with surname first, followed by initials (e.g. Smith, E. B.), and subsequent authors are to be listed with initials first.Separate author's initials with a single space. The year of publication should appear in parentheses immediately before the title of the citation. The entire journal name or book title should be spelled out. Please put a space after the colon when citing volume number and page numbers.

8. Italicize all scientific names. Voucher specimens must be cited in floristic works and in any other study whose results depend on the identity of the plant(s). Papers citing plant records without documenting vouchers are generally not acceptable.

9. Manuscripts must be submitted electronically to the email address of the editor. All manuscripts will be reviewed by at least two referees.

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On the cover: *Burt Barnes poses with a large specimen of his preferred species for study, Populus tremuloides, July 20, 1987. Photo courtesy of the Burton V. Barnes estate.*